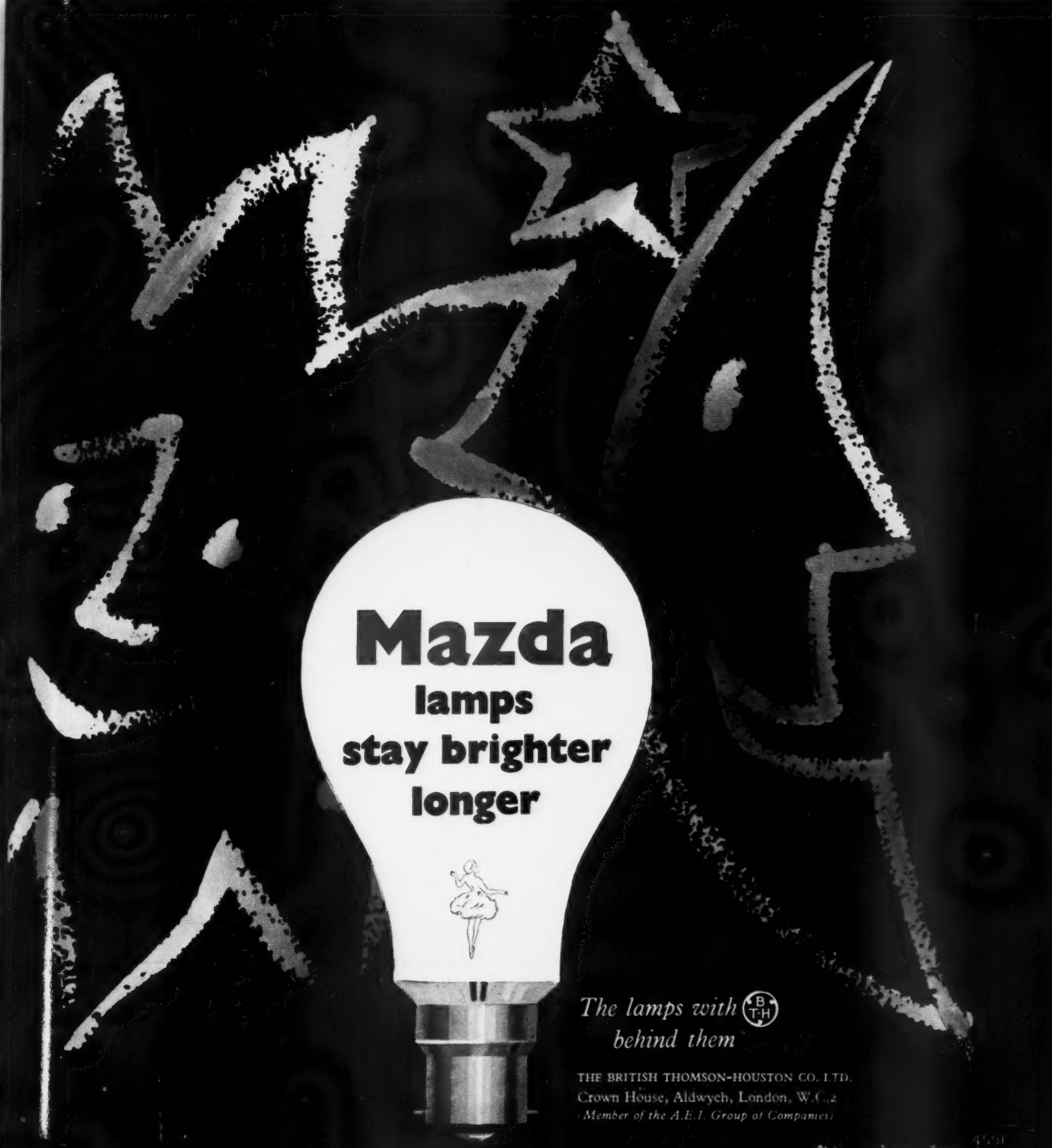
ELECTRICAL REVIEW

UNIVERSITY OF MICHIGAN
ENGINEERING

15 JULY 1955 PRICE 1s 6d



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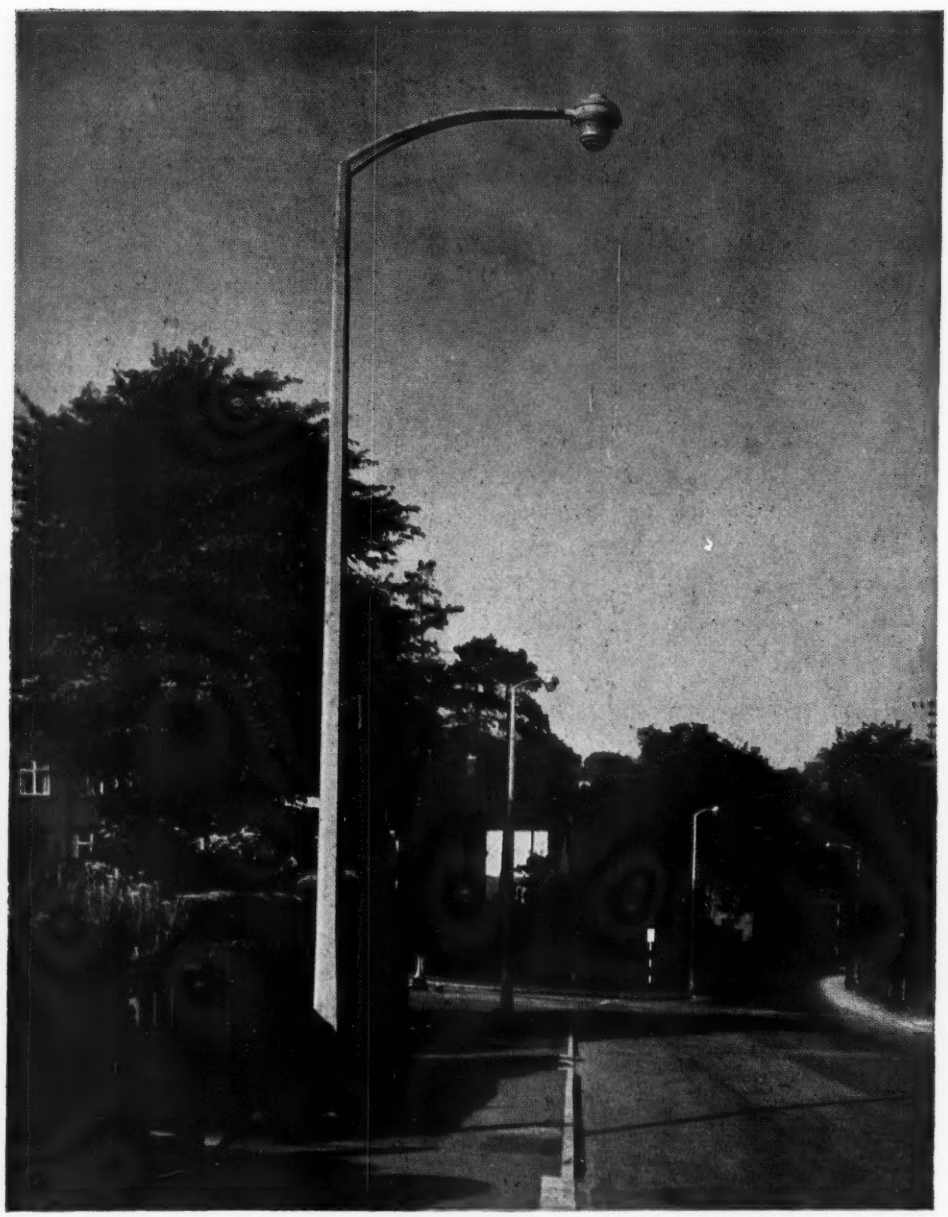

THE STANTON IRONWORKS COMPANY LIMITED—NEAR NOTTINGHAM

ELECTRICAL REVIEW

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29 JULY 1955

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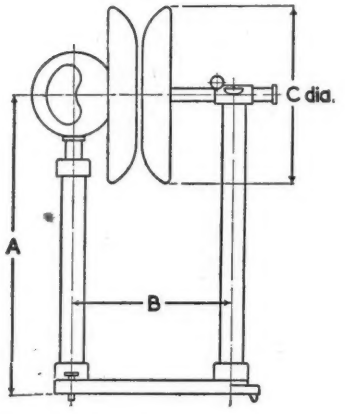

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ELECTRICAL REVIEW

29 July 1955 Vol. 157 No. 5 Established 1872

The 1954 Power Stations

EARLIER this year the British (now Central) Electricity Authority announced that the new generating plant installed during the year 1954 represented an additional output load capacity of 1,431 MW. This plant comprised twenty-nine turbo-alternators with an aggregate installed capacity of 1,405 MW together with seventeen diesel engined generators with an installed capacity of 25.78 MW. Altogether, new plant was installed in forty-three stations and in six of these plant was installed for the first time.

In these new stations, Acton Lane " B," Drakelow " A," Hackney " B," Ince, Stella South and Ashford " B," a total of seven generating sets representing 244 MW was installed; ultimately these stations will have an aggregate capacity of 1,120 MW. During the past few weeks we have visited all of these stations and an article describing the first of them, Drakelow " A," is published in this issue. Descriptions of the other stations will be published during the next few weeks.

One might tend to think that power station practice has now reached a stage where very little further development can be made and that as a result new stations are all very much alike. This is far from being the case, as we saw during our tour. Ashford, for instance, has five diesel driven sets and it is intended for peak load operation only, as also are the stations at Hackney and Acton Lane, where 30 MW sets are installed. The other three stations, where 60 MW sets are installed, operate on the base load principle. Thus different duties mean different designs, smaller sets being employed for peak loads. At the same time, site conditions, particularly in relation to fuel and water, greatly affect design.

The demand for power in this country continues to grow and by 1965 the total generating capacity installed in the Central Electricity Authority's power stations is planned to be about 35 to 40 million kW. As we need not only more power but more efficiently generated or cheaper power, steam pressures and temperatures are being raised and larger individual generating units are coming into use. Before the war the highest steam conditions, with few exceptions, were 600 lb/sq in and 800/850 deg F with 30 MW sets as in the Hackney and Acton Lane stations. The next step, represented by Stella South, was the adoption of 60 MW sets and steam at 900 lb/sq in and 900 deg F and many stations of this type have come into service since Vesting Day and are projected for future building. Last year, however, another major step forward was made with the commissioning of Drakelow " A " where the steam conditions are 1,550 lb/sq in and 1,050 deg F and 60 MW sets are employed. In Drakelow " B " the same steam conditions will obtain but 120 MW sets will be installed. What of the more distant future? Still higher steam pressures are being advocated and designs for 200 MW sets have been completed. It is not unlikely that before many years have passed we shall see 400 MW sets operating at pressures around 3,000 lb/sq in and perhaps even higher in the quest for increased thermal efficiency.

MORE POWER FROM OIL

Close upon the signing of the contract with the Esso Petroleum Co. it was announced last week that the Central Electricity Authority had concluded an agreement with Shell-Mex and B.P. for fuel oil supplies for a further seven power stations. Altogether, by 1960 oil equivalent to nine million tons of coal a year will be used, some of it of the low flash-point grade that will ease refinery difficulties. Serious as is the decision to turn to imported fuel, it needs little imagination to visualize the calamitous consequences to the country's economy of a shortage of fuel (and therefore of power) between now and the coming of nuclear generation on an effective scale. In explaining his proposals for removing the "spectre of the coal gap" in last week's debate in the House of Commons, the Minister of Fuel and Power said it had been reluctantly decided that there must be a sharp cut in coal exports. With the increased use of oil and the fuel efficiency campaign, this would afford the mining industry the necessary relief to drive ahead with its own tremendous reconstruction plans. A clear corollary is that the relief must be paid for and that the country's manufacturing industries will be called upon to make even greater efforts in the export field.

TECHNOLOGICAL EDUCATION

In *The Times* last week the Presidents of the Institutions of Electrical, Mechanical and Civil Engineers jointly tackled the Minister of Education on the recent official announcement that he is setting up a Council for the purpose of introducing and administering a new national award in technology in technical colleges, on the grounds that the policy upon which the Minister has decided differs materially from that which the Institutions have advocated in discussions with him and his predecessors. The point of difference seems to be that whereas the Minister of Education's move would tend to increase the number of colleges serving the engineering professions, the Institutions' view is that technological education would be best served by a comparatively small number of technical colleges in which the best use could be made of the limited number of teachers available. But it seems to us that both these aims miss the real mark in relation to the national emergency of the shortage of technologists. The real difficulty is to fill the places in the colleges and universities by tackling the problem where it really lies—in the schools.

ELECTRONICS IN THE FACTORY

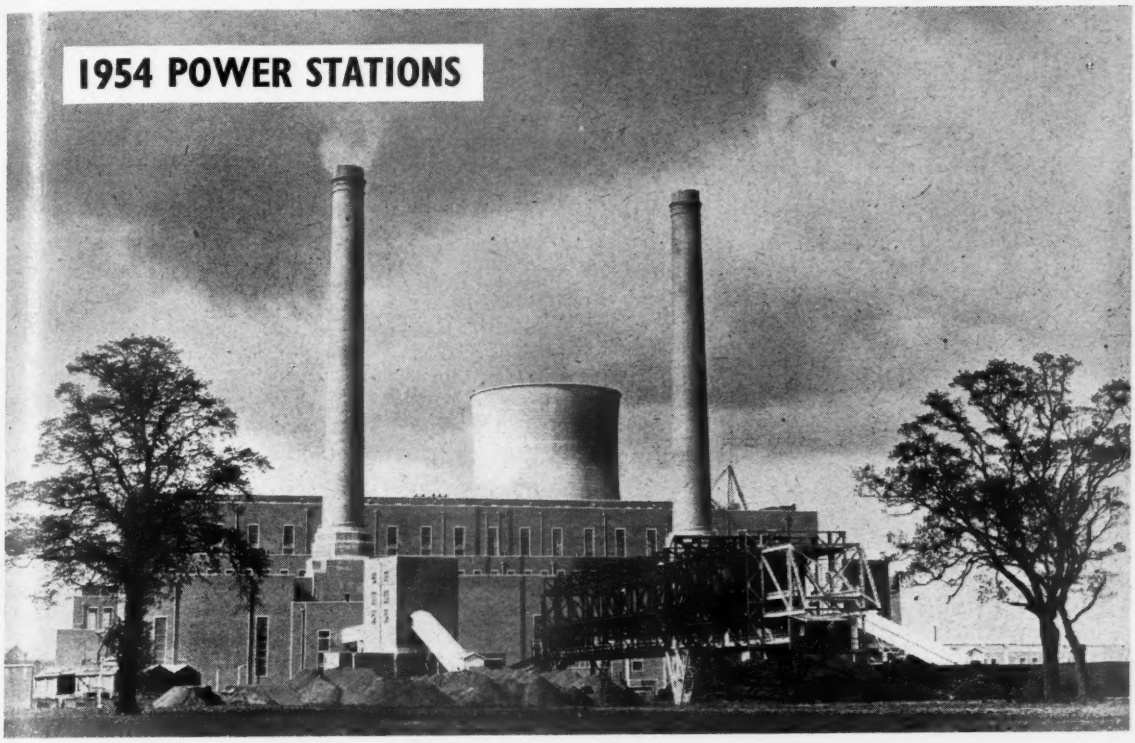
The conference of the Institution of Production Engineers at Margate showed up a belief among those concerned with the factory floor that much electronic gear being produced for industry still looked to radio practice for many of its standards, with a consequent lack of that robustness necessary for trouble-free operation. Our article this week on the Guard Bridge Paper Works, where an elaborate system of electronic control was initiated on a new paper-making machine two and a half years ago, brings out the same point. Valves give little trouble, contrary to the immediate doubts of the layman, and are ready subjects for a continuous check on performance, but such things as switches and relays—the mechanical items—when subject to the dusty atmospheres and perhaps heavy-handedness of machine operators, can easily prove a source of annoyance. A great many manufacturers are now entering the field of industrial electronics and it is vital for the steady development of confidence in their new methods that particular attention should be paid to the mechanical design, not only of housings and cabinets but also of individual components. Miniaturization is growing in the radio industry but at present we think it wiser to concentrate on strength and on ready accessibility for the maintenance staff, many of whom have to learn something of the technique when no longer young.

THE B.I.F. ELECTRICAL SECTION

As was expected, it has now been decided to transfer the Electrical Section of next year's British Industries Fair from Castle Bromwich, Birmingham, to Olympia, London. In making the announcement, British Industries Fair, Ltd., says that the decision has been made in response to views expressed by large sections of the industry, and it is supported by the British Electrical and Allied Manufacturers' Association and other organizations. While electrical concerns who wish may still exhibit in Birmingham, we think that it is desirable that the Electrical Section in London should be fully representative of the industry. It is hoped that, with the transference of the Section to London, electrical manufacturers who formerly exhibited at the Fair but have dropped out will return and thus make the display as complete as possible.

INDIAN MANUFACTURERS' PROBLEMS

Speaking at the annual meeting of the Indian Electrical Manufacturers' Association, Mr. L. P. Shah, the president, protested against the Indian Government's decision to set up a State-owned factory for the production of heavy electrical equipment. This, he said, would deprive the manufacturers of Government orders which constituted the bulk of their work and lead to serious overlapping. Moreover the proposed factory would compete with them for raw materials which would create difficulties in times of stress. Mr. Shah also referred to the Government's import policy with appreciation but said that there were loopholes in it of which importers had taken advantage, particularly in the case of motors. Another matter adversely affecting Indian electrical manufacturers was the recent spate of orders for transformers from State Governments. Mr. Shah said that although the Indian industry had equipped itself to meet a heavy demand it expected that that demand would have been spread. Now, taking advantage of the long delivery period which Indian manufacturers were forced to quote, the State Governments insisted that the equipment must be imported. He was going to urge that the Government of India should pool State requirements and place contracts over, say, a period of five years.



DRAKELOW

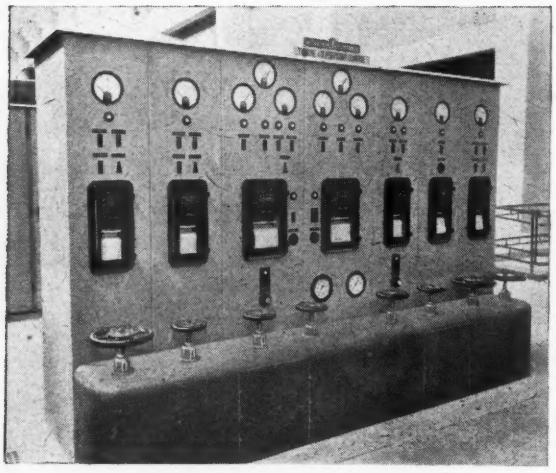
High-Pressure High-Temperature Station Nearing Completion

THE 240 MW base load generating station near Burton-on-Trent, which is known as Drakelow " A," is now in an advanced stage of construction and the official opening ceremony is planned to take place in October this year. Two of the four 60 MW sets are already in commission and the others are expected to be in service by the end of the year. Construction work is in progress for Drakelow " B " station on the same site and this will have four 120 MW units, bringing the total capacity up to 720 MW. The programme date for commissioning the first unit in the " B " station is 1958.

The selection of this site, on the south bank of the River Trent about three miles from Burton, was made by the former Central Electricity Board, Birmingham Corporation and Burton Corporation. On nationalization the plans were implemented by the Midlands Division of the then British Electricity Authority, although for operating purposes the station falls within the East Midlands Division of the Authority. The site is in the grounds of what used to be Drakelow Park, which dates back to Norman times. The decision to site a large generating station in this locality was largely due to the availability of large quantities of suitable coal within a few miles, it now being generally more economical to transmit power to the areas where it is required than to transport coal and to site generating plant at the load centres. The potentialities of the River Trent as a source of cooling water and make-up finally fixed the site although it will not be possible for the station to run solely on river cooling. There is also adequate road and rail access for coal supplies. The station has been designed and constructed to the plans and specification of Mr. F. W. Lawton, who was Divisional Controller, Midlands Division, until 1951. Messrs. Mouchel & Partners were the civil engineering consultants and Mr. J. H. Somerset, A.R.I.B.A., the architect.

The main building is a red brick structure 575ft long and 340ft wide with two 360ft high brick chimneys. Four 60 MW hydrogen cooled turbo-alternators are disposed longitudinally down the turbine room and the plant, which is designed on a unit basis, follows modern practice in that there is no dividing wall between the turbine and the unit boiler. The control room is at the end of the turbine room and is structurally part of the office block which is laid out at turbine operating floor level. The layout of both " A " and " B " stations is symmetrical about the administration block and control room. Included in the office block are modern locker rooms, showers and other facilities for the manual staff. There is also a well-equipped medical centre. A canteen is situated at the east end of the station. The workshops and stores are situated between the two stations for ease of access. The workshop block containing mechanical, electrical and instrument shops is laid out with adequate machine tools to enable the majority of breakdowns and repairs to be covered on site. At present the " A " station has one cooling tower but it is proposed to build another similar tower alongside the main building, together with two more towers for the " B " station.

The control room has been designed to cover both the " A " and " B " stations and a photograph on page 197 shows the 132 kV control panel, loading desk for the " A " station, 3·3 kV auxiliary control panel and control desk for the four river water pumps. Each loading panel for the



No. 1 turbine supervisory control board

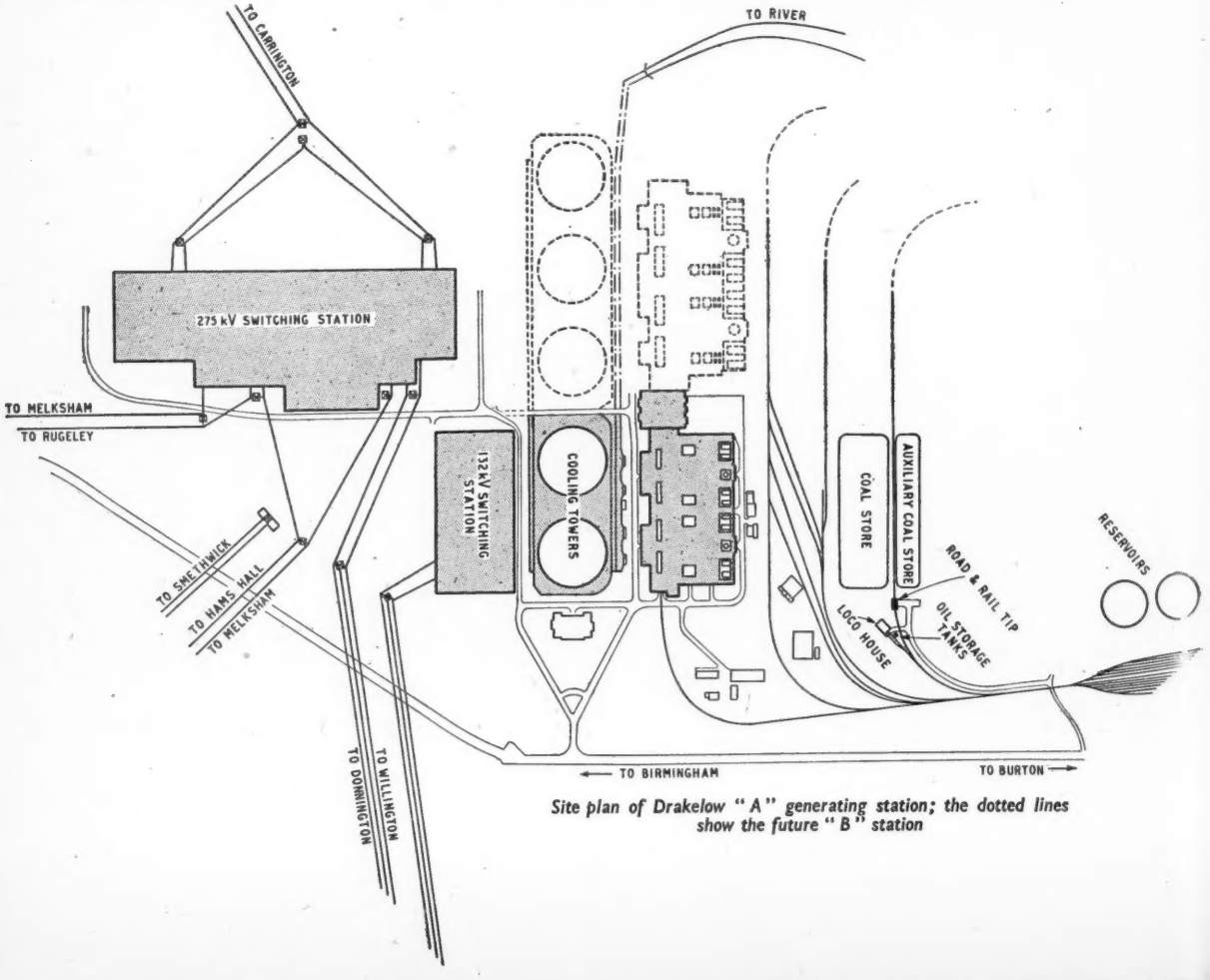
sets is unusual in that it has remote indication of steam pressure and temperature, condenser vacuum and alternator rotor temperature in addition to normal instrumentation. From this the control engineer has an adequate picture of operating conditions to enable him to load the units satisfactorily.

Each of the four English Electric 3,000 r.p.m. turbo-alternators is a three-cylinder, tandem compound unit with a double-flow low-pressure cylinder exhausting to twin condensers. With the designed steam conditions of 1,500 lb/sq in pressure and 1,050 deg F temperature at the stop valve and a vacuum of 28·75in Hg at the condenser flange, the estimated steam consumption at the full load of 60 MW is 475,000 lb/hr. The final feed temperature at this load is 430 deg F.

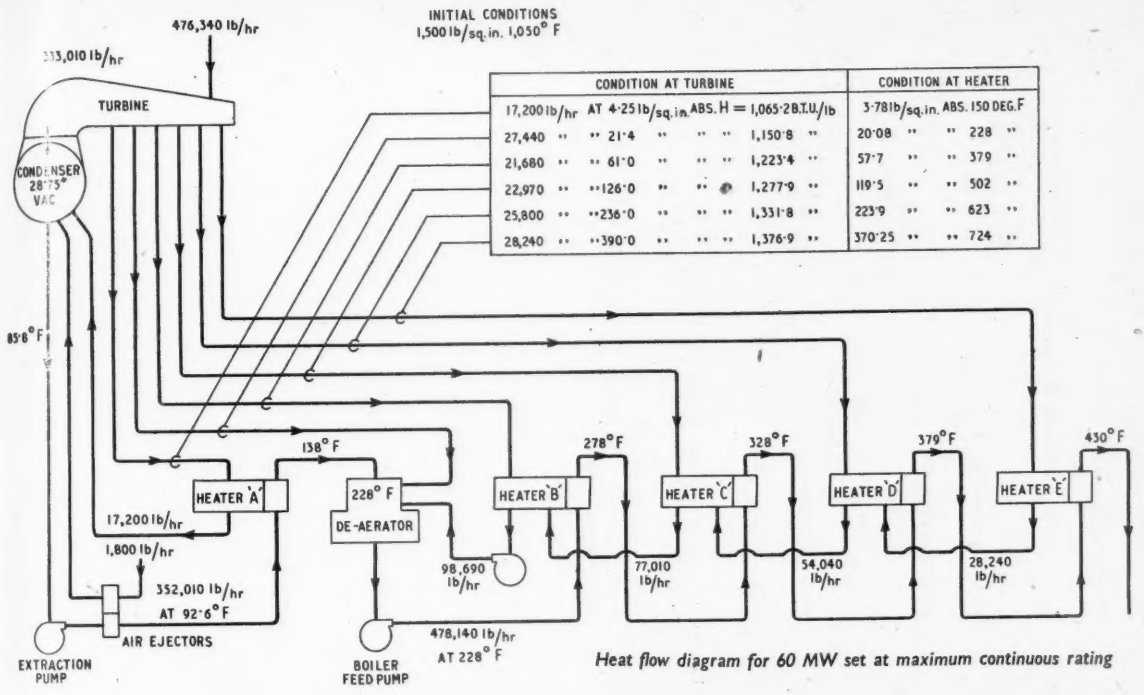
The three cylinders consist of a high-pressure, intermediate-pressure and low-pressure cylinders. In the high-pressure cylinder is a Curtis wheel and ten pressure-compounded impulse stages, in the intermediate-pressure cylinder 19 impulse stages, and the low-pressure cylinder has two impulse stages and 14 reaction stages. The last two reaction rows of blades on the low-pressure rotor have stellite shields to delay the effects of erosion by condensed water droplets entrained in the exhaust steam.

The turbine glands are steam packed from an auxiliary range on starting up and up to a load of 10 MW, at which load the steam supply is changed to bled steam. The turbine is protected by a vacuum unloader and a low vacuum trip, the latter actuating a relay which trips both steam and electrical sides. The low-pressure exhaust end of the turbine is protected by both an atmospheric valve and a rupturing diaphragm.

Perhaps the most modern trend in turbine control is the inclusion of comprehensive supervisory equipment. Two instruments indicate the relative positions of shafts and cylinders for both high-pressure and intermediate-pressure sections of the turbine. In addition high-pressure and intermediate-pressure spindle eccentricities are measured, indicated and recorded. Further instruments on this control panel, which is situated adjacent to its associated turbine, are throttle opening, turbine speed, high-pressure cylinder movement, and vibration indication for three turbine pedestals. This equipment marks a considerable advance in power station practice and is invaluable when commissioning and running turbines working at these advanced conditions of temperature and pressure.



Site plan of Drakelow "A" generating station; the dotted lines show the future "B" station



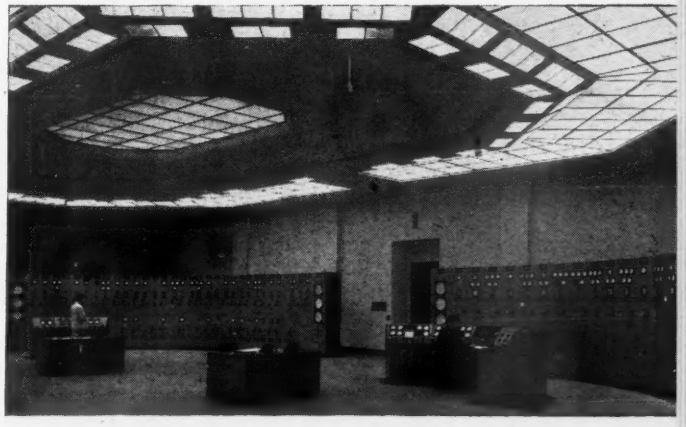
Heat flow diagram for 60 MW set at maximum continuous rating

The condensers are of Worthington-Simpson manufacture and are twin units with a total area of 55,000 sq ft and they are designed to handle 354,000 lb/hr of steam at full load. They are of regenerative design and are drained by two 100 per cent duty electrically driven extraction pumps. The circulating water is arranged to flow through the condensers twice, passing along the bottom half of the tubes and back through the top half to the inlet culvert of the 3·82 million gal/hr cooling tower. About 31,800 gal/min of water is required on full load and the temperature rise with this flow and load is about 17·5 deg F. The water is supplied by any two of the three 16,300 gal/min 50 per cent duty circulating water pumps driven by two-speed motors, low speed being selected when discharging to the river and the high speed when discharging direct to the cooling tower.

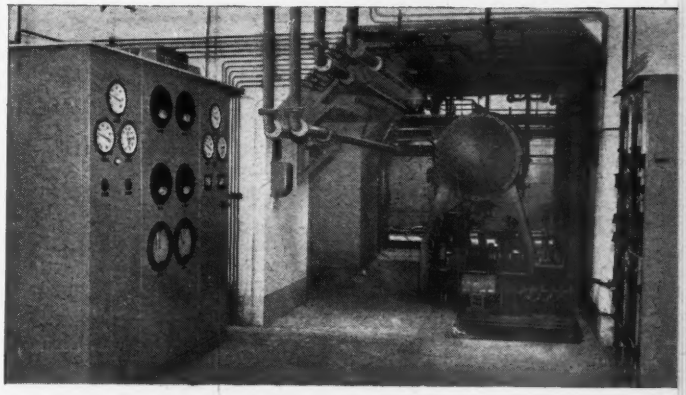
There are also two auxiliary water pumps in the system, which obtain their water from the same suction pipe as do the circulating water pumps. The 100 per cent duty units pass 650 gal/min to the alternator hydrogen cooling system, cooling water pump bearing coolers, boiler feed pump air coolers, bearings and glands, and to the heater drain pump bearings. The water is then discharged back into the suction culvert, which is charged either from the circulation through the towers or by river water pumped up by any of four 2 million gal/hr vertical pumps. The station is thus designed for possible operation on river water and/or cooling towers.

There are six stages of bled steam feed heating; on the low-pressure side there are one heater and a de-aerator heater, while on the high-pressure side there are a further four stages bringing the feed temperature up to 430 deg F when the unit is on full load. A de-aerator is included in the circuit to minimize the oxygen content of the feed-water to the boiler. Each feed heater has an automatic anti-flooding device operating a system which isolates the heater on the steam side and by-passes it on the water side.

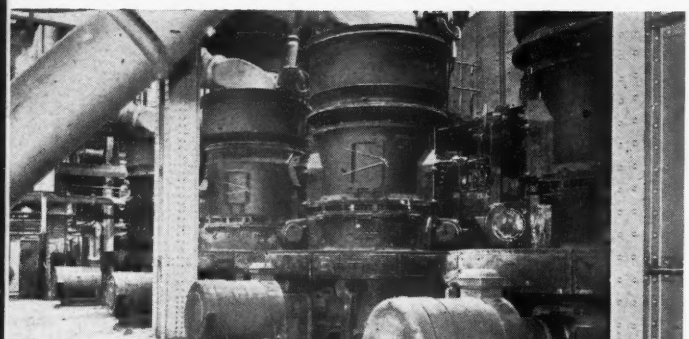
To enable steam to be supplied to the turbine at a suitable temperature for running up, a steam dumping



The control room has been designed to cover both the "A" and "B" stations



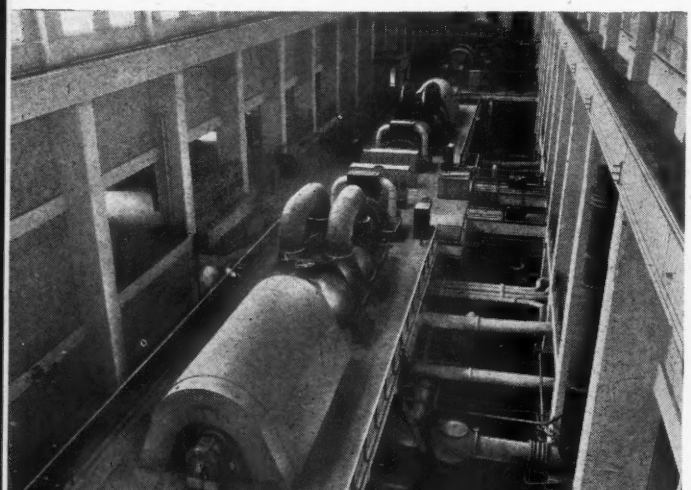
Hydrogen cooling control panel and oil seal pumping unit



Each boiler is fed by four "Lopulco" 15 tons/hr pulverizing mills

system is included. This is so that a large quantity of steam may be passed through the boiler superheaters to enable an adequate temperature being attained before admission to the turbine. Because of the high temperature and pressure at which the plant operates the pipework between boiler and turbine is made from austenitic steel, which has a comparatively low creep rate. The high-pressure cylinder of the turbine is made from ferritic steel. Since it is impracticable to weld austenitic to ferritic steel a transition piece must be interposed between the two. This consists of a composite casting having one end austenitic and the other ferritic. This casting tends to deteriorate due to, in the main, the different coefficients of expansion of the two materials if it is subjected to cyclic temperature variations. To overcome this, each transition piece, and there are ten per unit, is fitted with an electric heater which is automatically brought into service on shut-down of the unit and maintains the temperature at a predetermined level. It is intended that these heaters shall only be used to cover relatively short shut-downs and on any prolonged outage the transition piece will cool to ambient temperature and pass through the cyclic variation. There is a recording and control panel for each unit.

The 60 MW hydrogen-cooled turbo-alternators are disposed longitudinally down the turbine room



The alternators are hydrogen cooled and designed for initial operation at a hydrogen pressure of about 0·5 lb/sq in. At this figure the alternator rating is 75 MVA, generation being at 11·8 kV with a direct connection to a generator transformer stepping up to 132 kV. Teed off the 11·8 kV connection is a 7·5 MVA unit transformer stepping down to 3·3 kV for unit auxiliaries. The hydrogen circulation is by integral fans, the hydrogen passing through water coolers in its circuit. Hydrogen sealing is by means of a seal-oil system which includes a de-gasifier in its circuit.

Steam-Raising Plant

The four International Combustion boilers have the most advanced operating conditions so far adopted in this country. Each unit is designed to evaporate 515,000 lb of steam per hour at 1,550 lb/sq in and 1,060 deg F and is unit-coupled to a 60 MW turbo-alternator. The design has been based on the use of low-grade Midland fuels having a gross calorific value, as received, of 8,770 B.Th.U./lb with 21·5 per cent ash and 14 per cent total moisture. The ash fusion temperature, 2,075 deg F in a reducing atmosphere, is low and this, allied to the high steam temperature, has necessitated careful consideration of the furnace design to achieve the specified condition of continuous operation for periods of up to 14 months with only on-load cleaning. The plant also has to be capable of two-shift operation.

The boilers are supplied by two 100 per cent duty electrically driven feed pumps by Weir/E.E.C. and incorporate an automatic low-pressure cut-in device to cover the possible failure of one pump whilst in service.

The boilers are of three-drum radiant design, arranged for corner firing. The combustion chambers are completely water cooled by close pitched bare tubes on the side walls, and by finned tubes on the front and rear walls and roof. Gases leave the furnace through a specially designed exit channel which screens the high temperature sections of the superheater from direct radiation from the combustion zone. To attain the high final steam temperature, no water-cooled screen is provided between the front and rear walls before the superheater. After traversing the widely spaced high temperature sections of the superheater, the gases, now cooled below the ash fusion temperature, pass vertically downwards through further banks of superheater elements and a small amount of convective heating surface to the economizer and air heater. The whole boiler and superheater unit is suspended from a rectangular steel structure and is completely free to expand in a downward direction.

Feed, at 430 deg F, passes through twin "Senior" all-welded type economizers and enters the feed drum at the rear of the boiler by multiple risers. Cool feed for the furnace walls is taken from the feed drum by 3in o.d. downcomers to the bottom boiler drum and by 5in bore pipes from this drum to the various wall headers. The risers from the side walls discharge into the front steam drum, the steam from which is delivered into the feed drum through three rows of 3in o.d. tubes.

The "Melesco" superheater is built up in five stages, all in series, of which three are in the low temperature zone and two in the high temperature. The low temperature stages are arranged horizontally and the high temperature stages are of the pendant type. Control of the final steam temperature is automatically maintained within ±10 deg F by altering the vertical angle of tilt of the fuel burners. The resultant raising or lowering of the flame mass increases or reduces the furnace cooling surface presented to the gases, thus maintaining the furnace exit temperature at the required figure for the load on the boiler. Operation of the burner nozzles is performed by

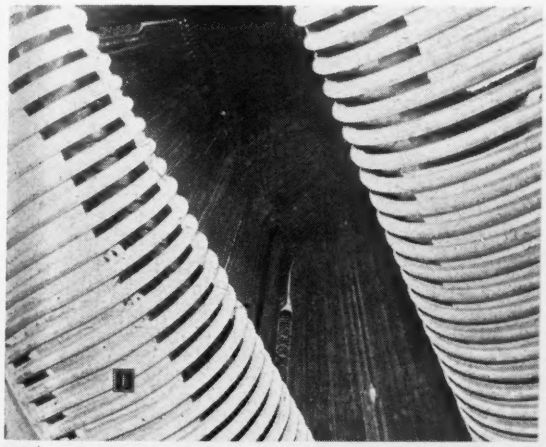
pneumatic cylinders, actuated by a Kent "Multelec" steam temperature controller and recorder. Coarse control of steam temperature, to maintain it within the operating limits of the burner tilting feature, is obtained by a manually controlled, power actuated damper which may be opened to by-pass a proportion of the gases around the three low temperature stages of the superheater.

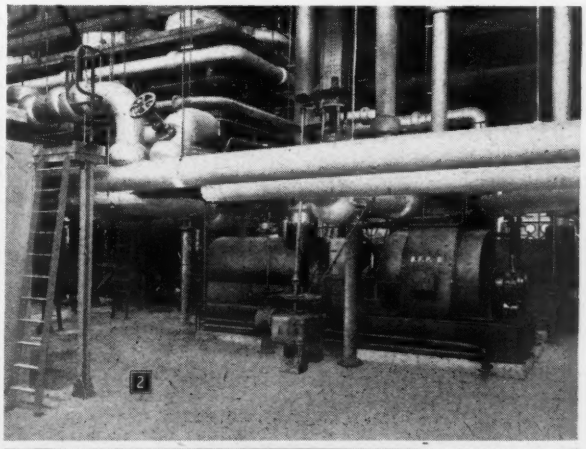
After leaving the boiler proper, the gases divide into two parallel and identical streams, each circuit containing a Ljungstrom regenerative type air heater, Sturtevant electrostatic precipitator and Davidson i.d. fan.

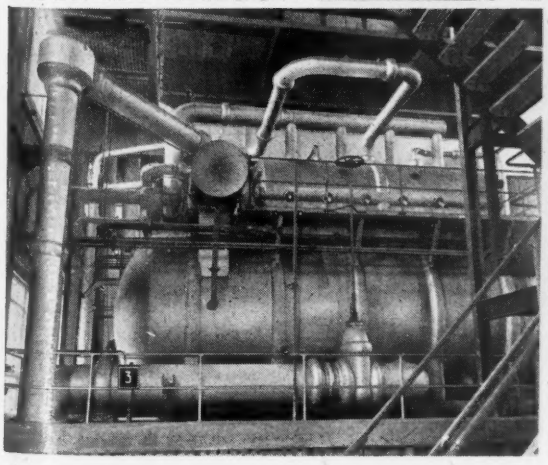
Mr. H. Greenwood, superintendent of Drakelow "A"

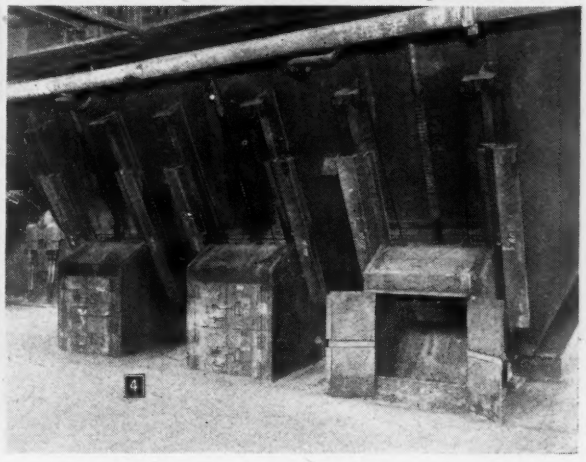
The coal pulverizing plant consists of four "Lopulco" type LM16 15 tons/hr capacity mills per boiler, each driven by a 185 h.p. motor and swept by a Keith Blackman exhauster. The design enables full load on the boiler to be maintained when burning very low-grade fuel having a moisture content of up to 25 per cent. Coal is delivered from four bunkers, one for each mill, with a total capacity of 600 tons. At the side of each mill there is a rotating variable speed feeder table. Each mill delivers to one burner nozzle in each corner of the furnace, the nozzles being arranged to fire tangentially to an imaginary circle at the centre of the combustion chamber. The four nozzles at each corner of the furnace are mounted vertically one above the other in a single casing and are coupled together for simultaneous tilting by the Kent steam temperature controller. Two Wallsend Slipway pressure type oil burners are fitted in each corner burner casing, the total capacity being sufficient to steam the unit up to 80,000 lb/hr on oil alone.

Two Davidson forced draught fans deliver air to the preheaters, from which a portion is taken to the mills for drying the fuel and conveying it to the burners. The remainder is delivered around the burner nozzles as secondary air. The i.d. and f.d. fans, coal feeders and mill classifiers are driven by variable speed commutator motors of Laurence, Scott and Electromotors manufacture, fitted with induction regulators. Alteration of the regulator position is effected from the control panel by a pilot motor. The furnace draught is maintained constant by Bailey control gear, which provides an automatic pneumatic control of i.d. fan speed. Boiler water level is maintained steady by a Copes system, incorporating thermostats on the drum and a "Flowmatic" diaphragm on either side of which steam pressure is transmitted from the secondary superheater inlet and outlet heaters. By this means there is control of two Gordon Anderson valves with variable port openings, fitted also with a pressure compensatory device, and these two valves control the feed









(1) The combustion chamber during construction viewed vertically from ash hopper level and showing two sets of burners. (2) Each boiler is supplied by two 100 per cent duty electrically driven feed pumps. (3) To minimize the oxygen content of the feed water to the boiler a de-aerator is included in the circuit. (4) Bottom of No. 1 boiler showing hydraulically operated ash doors above the ash sluice

to the boiler from the high-pressure heaters at 430 deg F. Chemical treatment of the water is provided for by a pressure system delivery to the feed drum by a chemical dosing arrangement utilizing the pressure drop through the economizer as the motive force.

The soot blowing arrangements are most comprehensive and comprise eight gun type blowers, two lance-type blowers in the combustion chamber, and fourteen lance-type blowers in the superheater passes. All blowers are arranged for electrical operation and remote automatic control of the sequence follow-on type. The main ash channel from the boilers is sluiced with river water and carries away ash from the boiler main ash hopper and also from the hoppers beneath the primary superheater, rear pass and economizer. The grits collected in the precipitators are removed by a conveyor via a sealed rotary valve to another sluice. The water-borne ash and dust is pumped by means of rotary ash sluice pumps to the top of an inclined launder down which it flows to the settling lagoons a few hundred yards away from the station. The settling lagoons are old gravel pits and an area of 25 acres has been allocated for the disposal of ash. The area includes old gravel pits, existing workings and proposed future workings. It is estimated that the disposal site will be adequate for 25 years' running of the combined "A" and "B" stations.

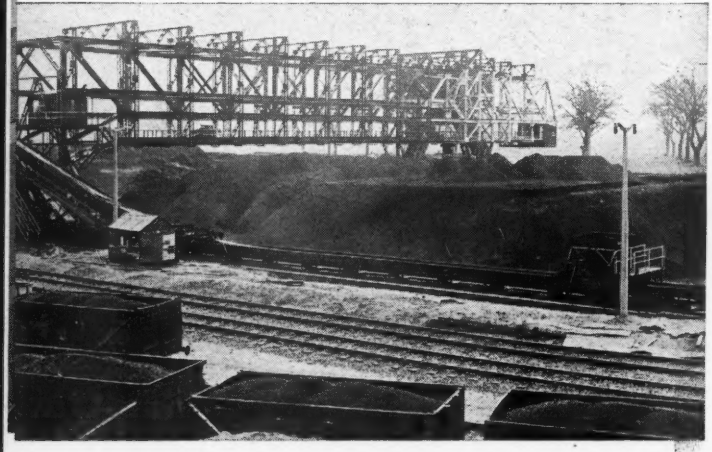
Coaling Plant

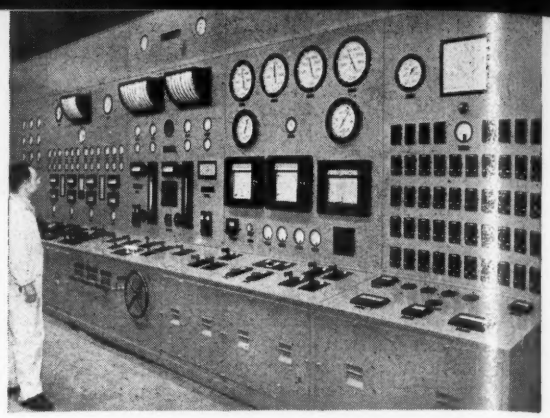
The coaling plant, which was supplied by Mitchell Engineering, Ltd., is designed to handle rail- and road-borne coal at a maximum rate of 120 tons/hr to each boiler, or at 240 tons/hr to or from the 56,000 tons capacity stacking ground. Coal can be unstocked by a transporter-elevator at the same rate.

Rail-borne coal is delivered from the main Burton to Leicester line via the station sidings to wagon tipplers of the self-weighing type. From the tippler hoppers the coal is fed by apron feeders into two gravity bucket conveyors which deliver into a common hopper at the top of the gravity bucket house. Before leaving these conveyors the coal stream passes under a short overband fitted with electrically magnetized studs to remove tramp iron, which is rejected into a separate hopper. The two conveyors discharge into hoppers containing flapper plates delivering to two further conveyors. These are reversible and run in opposite directions to the conveyors which discharge finally to bunkers 1 and 2.

Coal by road, after passing over the weighbridge is discharged into the hopper of an apron feeder from whence conveyors take it to bunkers or stock as required. Bottom-emptying rail wagons are also handled by this section of the plant. As usual the plant is electrically operated with a comprehensive system of sequence interlocks. The plant is designed to be flexible so that it is possible to stock coal from road or rail, while at the same time sending coal to bunkers.

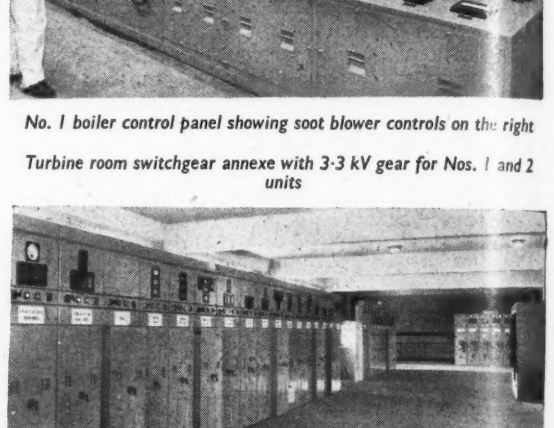
General view of the coaling plant





No. 1 boiler control panel showing soot blower controls on the right

Turbine room switchgear annexe with 3·3 kV gear for Nos. 1 and 2 units



Interconnection with 275 kV System

The "A" station generator transformers feed into a 132 kV outdoor substation in close proximity to the station. The adjacent 275 kV outdoor substation is nearing completion, it being intended to bring it into service some time next year; it will have twenty 7,000 MVA air blast switches when finally completed. Two interconnecting transformers will link the 132 kV and 275 kV systems, remote switching on both systems being effected from the station control room. The internal station supplies are at 3·3 kV and 415 V, supplies being divided between unit transformers and two 10 MVA station transformers fed from the 132 kV busbars. Switchgear on both 132 and 275 kV is of the Reyrolle air blast type, while the 3·3 kV indoor equipment is of the cubicle type of the same manufacture.

Acknowledgment is due to Mr. L. F. Jeffrey, Divisional Controller, East Midlands Division, Central Electricity Authority, for permission to publish this article, and to Mr. H. Greenwood, the station superintendent, for invaluable assistance in the preparation of the material.

The main contractors for the station are:—Civil engineering works, Sir R. McAlpine; boilers, International Combustion, Ltd.; turbo-alternators, English Electric Co., Ltd.; condensing and feed heating system, Worthington-Simpson & Co., Ltd.; steam and feed pipe work and central evaporators, Aiton & Co., Ltd.; coal-handling plant, Mitchell Engineering, Ltd.; first cooling tower, Mitchell Construction Co.; cables, British Insulated Callender's Cables, Ltd.; 132 kV, 275 kV and 3·3 kV switchgear, Reyrolle; main transformers, English Electric Co., Ltd.; water-treating plant, Wallace & Tiernan, Ltd.

WORLD ELECTRICAL MARKETS

Development in Malaya

By S. C. STOUT (United Kingdom Trade Commissioner, Singapore)

IN 1953 Malaya bought electrical equipment worth almost $65 million (£1=8·57 Malayan dollars) and in the first half of last year its purchases were about $32 million. About three-quarters of this equipment came from the United Kingdom; Malaya is one of the most valuable export markets for British manufacturers of electrical equipment.

Planned developments aim to ensure a supply of electricity sufficient to meet the growing demand of consumers. Electricity supplies have been available in Singapore since 1906 when the then Municipal Commission bought electricity from the Tramway Company and sold it over a limited area. In 1926 the Commission built its own power station and in 1941 additions were made to it. After the Japanese occupation the plant was found to be in a deplorable condition and plans were made to meet future demands. Further additions were made to the old station in 1948 and it now has an installed capacity of 37,000 kW.

A new station was planned in Singapore at Pasir Panjang; work began in 1950 and much of the plant has now been installed. Three 25,000 kW turbo-alternators and four boilers have been installed and a fourth set was expected to be commissioned in July. This fine new station, equipped with British plant, is designed for an ultimate capacity of 150,000 kW, which should be sufficient to meet the demand for many years to come. The peak demand on the two Singapore stations in 1954 was 65,500 kW, the output being 318·4 million kWh. The total revenue was $18·2 million.

Much headway has also been made in Singapore with the 22 kV transmission network; at the end of last year 90 miles had been laid and a further 48 miles had been installed with pilot cable and 150 miles of street lighting had been completed in the city and in the rural areas.

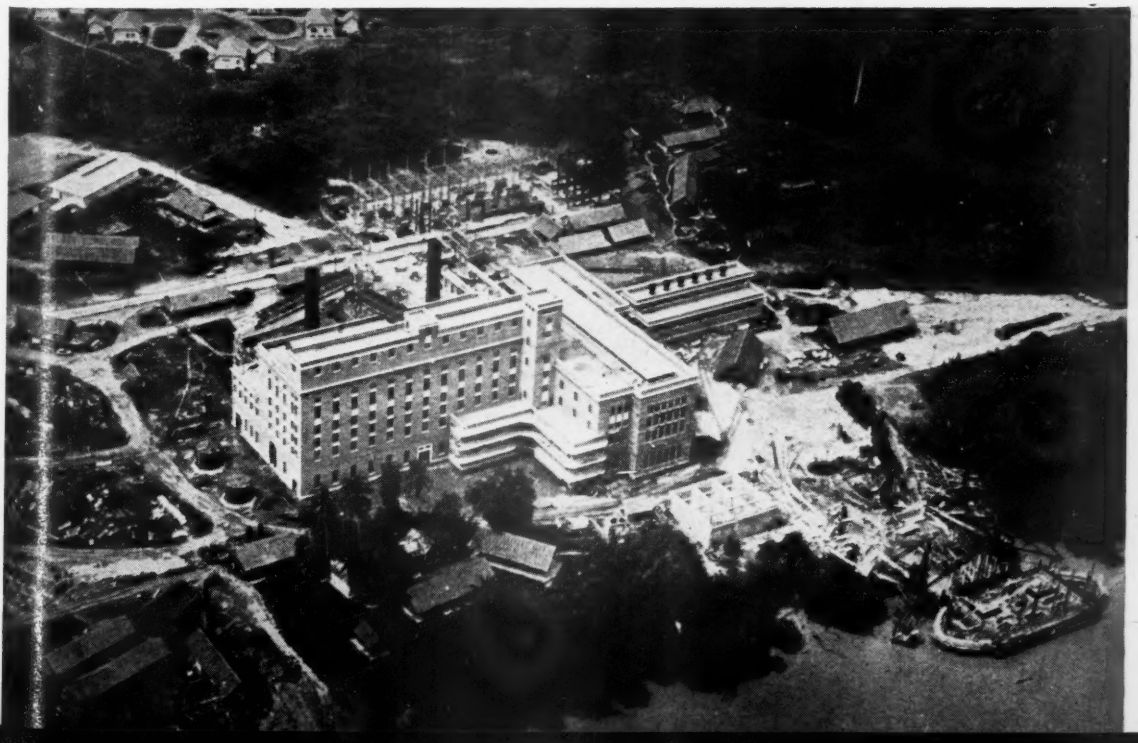
The electricity authority in the Colony of Singapore is the Electricity Department of the City Council which supplies consumers at charges designed to cover the costs of production. The charges are 17¾ cents per kWh for domestic lighting and 6 cents per kWh for domestic power (i.e., 4·97d and 1·68d respectively).

Power is distributed from the two stations over a 22 kV network to 279 22/6 kV substations, and consumer supply is at 230 V a.c. At the end of last year there were over 63,000 consumers and the number is rising.

The assurance of ample supplies of electricity has led to an increased demand from consumers for equipment. Such appliances as ceiling fans, water heaters and cookers are available on hire from the Electricity Department at moderate charges. At the end of 1954 the following equipment was on hire in Singapore:—Ceiling fans, 27,831; water heaters, 3,722; cookers, 8,195; and motors, 424. Typical hire charges are $1 a month for ceiling fans and small water heaters and $2 a month for cookers and large water heaters.

The electricity authority in the Federation of Malaya is the Central Electricity Board, although special provision has been made to enable the Municipal Commissioners of Georgetown, Penang, and others, to continue to operate their undertakings. Electricity was first supplied in Malaya in Penang in 1904 and in the following year in Kuala Lumpur. In 1919 the Kuala Lumpur supply was augmented by a station with a mixed generating plant totalling 1,450 kW. In 1926 the Prai power station on the mainland facing Penang was commissioned, with an installed capacity of 9,500 kW.

The Connaught Bridge power station of the Central Electricity Board, Malaya



General view of the new Pasir Panjang power station, Singapore, with flats built for the senior staff

In 1927 the Government Electricity Department became an independent Federal Department, responsible for supplies of electricity in the former Federated Malay States. In 1928 and 1929 the Perak River Hydro-Electric Power Company's steam and hydro-electric stations were put into commission. With generating plant installed in a number of other towns the total capacity at the outbreak of the last war was 140,000 kW. A total of 650 million kWh was generated in 1940.

The " denial " policy before and the neglect during the Japanese occupation resulted in about 60 per cent of the pre-war plant becoming unusable. It was apparent even before the war that the development of electricity called for the interconnection of large stations, the development of hydro-electric power, the scrapping of inefficient plant, and a central body in control. Accordingly the Central Electricity Board was established in 1949. It commenced operations with 34 stations totalling 39,880 kW. There was one steam power station of 26,500 kW, one hydro-electric power station of 2,280 kW and diesel power stations of 11,100 kW. Bulk supplies were purchased from other undertakings which were licensed by the Board to continue operating.

Immediately after the war work began on the new Connaught Bridge power station, but progress in the provision of adequate supplies was hampered by terrorist activities. The first stage at Connaught Bridge was achieved in 1953 with the commissioning of 40,000 kW of plant, consisting of two turbo-alternator units and four boilers. It was expected that the second half, comprising a further 40,000 kW, would be commissioned this year and would be fully loaded by 1958.

A double circuit 66 kV interconnector has been installed between the Connaught Bridge power station and the older Bungsar power station at Kuala Lumpur, and there is also a 66 kV transmission line from Kuala Lumpur to Seremban (43 miles) and Malacca (90 miles). Ultimately this line is to form an interconnector between the Bungsar power station and the new Malacca station, the first part of which is expected to consist of two 10,000 kW steam turbo-alternators.

The plans of the Board include the Cameron Highlands hydro-electric project which is estimated to yield 120,000 kW. Site surveys and borings have commenced, although work on this site is seriously affected by terrorist activity in the area. The first part of the project (60,000 kW) is scheduled to be in operation by 1962 and the balance by 1967.

During the year ended 31st August, 1954, the Central Electricity Board sold 241·1 million kWh for distribution to its customers. This represented an increase of 15·8 per cent over the previous year. The number of customers connected to the Board's system at 31st August last was 80,355.

Until recently domestic appliances were made available on hire by the Board but now only ceiling fans and water heaters may be hired. Other equipment such as cookers and refrigerators are available on hire-purchase arrangements with the Board. The hire of electric motors to tin mines continues.

The Perak River Hydro-Electric Power Company has a hydro-power station at Chenderoh on the Perak River, and two thermal power stations. These stations have a total installed capacity of 77,000 kW. In 1953 the company generated 373 million kWh, of which 283 million was used by dredges and open-cast mines.

The Municipal Commissioners of Georgetown, Penang, operate a power station at Prai, which supplies Penang Island by way of three submarine cables. A new power station is planned on Penang Island with a capacity of 50,000 kW. Orders have already been placed for two 10,000 kW steam turbo-alternators. The total expenditure is estimated at $24 million, which covers the cost of the station, transmission and distribution cables, etc.

This continuing expansion of generating capacity provides a market for British manufacturers of plant and equipment, cables, etc. The assurance of adequate supplies of electricity, the complete absence of gas supplies in the Federation of Malaya, and the limited gas supplies in the Colony of Singapore, make Malaya a promising market for manufacturers of domestic equipment. The value of these markets, with the United Kingdom's share, is illustrated in the following table of selected imports of electrical equipment into Malaya.

The climate of Malaya, which is characterized by high mean temperatures and high humidity, explains the need for air-conditioning and refrigerators. Imports of air-conditioning equipment into Malaya have been increasing during the past two or three years. There is a considerable and expanding market for domestic window models of ¾ h.p. and 1 h.p. capacity. At present the supply of such

MALAYAN ELECTRICAL IMPORTS (THOUSANDS OF MALAYAN DOLLARS C.I.F.)

Commodity	1953		1954 Jan. to June	
	Total	U.K.	Total	U.K.
Transformers, reactors and inductors ...	2,086	1,712	894	852
Generators	5,564	5,187	603	497
Electric motors up to 25 h.p.	929	841	392	363
Switchgear and control panels	1,730	1,721	1,511	1,509
Torch batteries	1,241	601	353	104
Electric lamp bulbs	1,176	819	745	528
Domestic radio receivers, mains	3,190	929	1,878	367
Transmitters and radio communications...	2,094	1,891	602	389
Telegraph and telephone apparatus ...	6,174	6,067	2,899	2,885
Electric cooking apparatus...	1,103	1,025	505	443
Electric lighting and signalling equipment for vehicles	1,915	689	108	76
Electric lighting sets for cycles			1,609	693
Electric wire and cable, except telegraph, rubber insulated	5,587	5,296	3,679	3,521
Electric wire, cable, other than telegraph, insulated other than rubber	5,856	5,777	1,562	1,526
Telegraph, telephone, wire, insulated	1,966	1,964	579	579
Accumulators	2,417	1,652	1,295	972
Ceiling fans	2,502	2,035	1,204	1,047
Table fans	889	506	291	143
Electric refrigerators up to 12 cu ft ...	4,586	2,302	2,084	711
Electric refrigerators over 12 cu ft ...	538	83	250	8
Deep freeze cabinets	91	3	231	1
Air-conditioning and refrigerating plant...	280	134	274	173
Air-conditioning units	2,349	47	1,047	11

units is virtually a United States monopoly. The type of set with assured sales is a well-designed container, colourful, with coloured knobs, chrome and gilt fittings with a ¾ h.p. sealed compressor unit, a five-year guarantee and costing (landed c.i.f. Singapore) about £100. Increased sales of "packaged units" up to 5 h.p. and even 10 h.p. may be expected. Modern hotels, restaurants, cinemas, banks, offices and so on are being air-conditioned with "tailor made" plant.

There is a steady demand for domestic refrigerators, about half of which come from the United Kingdom. Most of the refrigerators over 12 cu ft and about one-third of the smaller ones are imported from the United States. As with most electrical equipment popular demand is for a sleek, modern looking refrigerator with "gadgets," bright handles and name plates. A high white gloss is the most popular finish for the exterior with pastel shades inside. There is not much demand for the absorption-type for use with electricity.

Electric cookers, water heaters and ceiling fans are mostly obtained from one or other of the electricity authorities on hire or hire-purchase. The rates or terms for these are moderate and there is little incentive for consumers to buy outright.

The chief competitors of the United Kingdom are the United States for generators (the household variety), torch batteries and bulbs, photoflash lamps and fluorescent discharge tubes; West Germany for electric welding apparatus, cycle lighting sets and accumulators; Holland for filament lamp bulbs, domestic radio sets, valves and cycle lighting sets; Hong Kong for torch batteries and bulbs; Australia for transmitters and radio communication equipment and accumulators; and Japan for table fans.

In the Federation of Malaya a duty of 10 per cent *ad valorem* is charged on some electrical equipment, such as air-conditioning units, refrigerators, electric motors not more than 1 h.p., fluorescent tubes, torch cases, fans, cooking and heating appliances, flat irons, razors, washing and drying machines, mixing machines, etc. Batteries for torches and handlamps carry a duty of 25 per cent, with a preferential rate of 15 per cent, and all other batteries are chargeable at 30 per cent, with a preferential rate of 15 per cent. All this equipment is admitted duty-free to the Colony of Singapore. There are no import restrictions on electrical equipment and appliances from the United Kingdom and there is no local manufacture, except for some torch batteries.

Malaya is a keenly competitive market, with price a very important factor. The Asians are "brand conscious" and remain loyal to a brand that has given satisfaction. Design is also important, with a preference amongst consumers for colourful, gleaming and "showy" articles.

The programmes of the electricity authorities aim to provide consumers, both industrial and domestic, with adequate supplies of power. Both the suppliers and consumers of electricity require equipment and British manufacturers will find that the Malayan market is one well worth studying.

Overhead Line Jointing Equipment

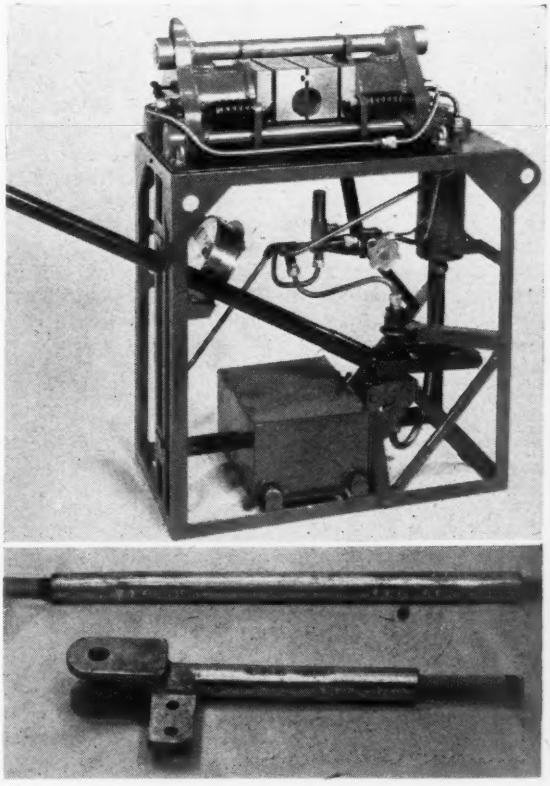
FOR the compression jointing of 61/·125 steel-cored aluminium overhead line conductor, Tate Brothers, Portslade, Sussex, have marketed a new hydraulic equipment enabling a joint to be made in less than ten minutes by one compression on the steel and two on the aluminium. The latest model, the Mark III, is similar in principle to earlier models in having a twin opposed ram action.

The distance between these rams is increased to take the larger dies for aluminium compression required for jointing 61/·125 s.c.a. and a small spacer block is inserted to permit the standard dies for steel and aluminium to be used. The compressor contains a relief valve which emits a noise when the full compression is reached and this avoids under- or over-compression. The rams return automatically. The reservoir on the new compressor is filled from the top of the table, thus facilitating examination or filling.

The compressor head is detachable for making off non-tension joints on the tower cross-arms, if required, and is then fed by flexible hydraulic hose. At a recent demonstration a 61/·125in s.c.a. dead end clamp was made off in six minutes, representing a considerable time saving. Because of the method of compression used, there is no "birdcaging" of the conductor and all joints are perfectly straight. Creepage does not occur and the operation can be carried out by almost unskilled labour.

A feature of the dies is that the main body does not move and that compression is by the movement of small keys in the die face, which eliminates die wear.

The main factory of Tate Bros. is now being rebuilt and re-equipped with new plant, the intention being to step up the production of jointing equipment and transmission line accessories, to meet an ever increasing demand.



Top: Hydraulic jointing equipment

Bottom: Completed compression joint

Nuclear Power Beginnings

Assessing the Rate of Progress

THE active interest displayed by the United Kingdom Atomic Energy Authority in the International Conference on the Peaceful Uses of Atomic Energy, to be held in Geneva during August, furnishes a significant footnote to the Queen's Speech on the opening of Parliament. On that occasion Her Majesty gave formal expression to the Government's intention to promote actively the development of nuclear energy for peaceful purposes.

The fulfilment of this intention has been possible, as the Prime Minister had previously acknowledged in a broadcast address, as a result of the remarkable progress made by British scientists towards producing electric power by this means. Particulars of the Government's initial plans for the construction within the next ten years of twelve nuclear power stations having an aggregate capacity of from 1,500 to 2,000 MW were given in the *Electrical Review* of 18th and 25th February. This scheme is the first of its kind in the world to envisage the full-scale use of nuclear energy solely for the generation of electricity, which provides the only known means of harnessing the new form of heat energy.

Progress has indeed been remarkable, outstripping the expectations of those in a position to appreciate the complexity of the scientific and engineering problems inherent in securing a controlled continuous release of energy, as distinct from the kind of instantaneous explosion that received its military manifestation in August, 1945.

Editorial comment in the *Electrical Review* at that time, which drew attention to the wide differences between the two aspects, proved later to be justified by extravagant hopes entertained by the lay public of shortly securing almost unlimited supplies of power for small-scale uses at negligible cost and, of more serious import, by questions raised in Parliament as to the wisdom of proceeding with the national programme for building urgently needed coal-fired power stations. Such ill-informed expectations vastly under-estimated the extent of the knowledge of nuclear physics that had still to be acquired before a standard of technical and economic performance could be reached that would match that obtainable in normal steam practice.

Nevertheless, despite post-war difficulties in securing materials, the competing claims of export, the paucity in numbers of men with the qualifications requisite for mastering new scientific concepts and techniques and the over-riding requirements of national defence, the verdict of history will probably be that no major scientific principle has ever been given so quick a beneficial application.

Electrical Analogy

The time lapse between discovery and use of the means of exploiting nuclear fission may be compared with the half century or so taken to bring the advantages of electro-magnetic induction to the public. In 1939, the researches of several independent investigations, including Chadwick, who had seven years earlier discovered the neutron (the electrically uncharged part of the nucleus of the atom) indicated that the neutron itself provided the means of securing the fission of uranium, the isotope U235 of which is the only spontaneously fissile element in nature. As in the case of electro-magnetic induction, the position had been prepared by forerunners. Rutherford in 1905 suggested that radioactive elements could yield enormous amounts of energy if their rate of disintegration could be controlled. Cockcroft in 1932, by artificially speeding up particles, proved such control to be possible.

The development of nuclear fission for peaceful purposes had to be suspended during the war and it was not until October, 1945, that the subject could be pursued in Great Britain. That date, therefore, gives a convenient starting point for assessing the rate of progress up to the present time. The Atomic Energy Research Establishment was then set up at Harwell (Berks) with Sir John Cockcroft as director, to be followed in the following January by the formation of a Production Group at Risley (Lancs) under Sir Christopher Hinton as managing director. Recent stages of progress at these places were described in the *Electrical Review* of 17th and 24th June and 1st July.

An immediately obvious result of the activities of these two organizations is the building of a power station at Calder Hall (Cumberland) for the dual purpose of providing plutonium, an artificial fissile element required both for military purposes and as " fuel " for later nuclear power stations, and also for generating up to about 80 MW, more or less as a by-product, which will be fed to the 132 kV grid. Calder Hall is not one of the twelve nuclear stations mentioned above, which are to be constructed by electrical and allied manufacturing concerns and owned and operated by the Central Electricity Authority (the first two of which are due for completion in 1960-61), but its commissioning date two years hence can be regarded as corresponding to 1882 in the electrical analogy.

Benefits of Organized Research

The twelve years since 1945 are then roughly comparable with the fifty-one years between 1831 and 1882, though the scientific and technological problems worked out in the shorter period have been of much greater complexity. This gain in time, of inestimable monetary worth taking a long-term view, provides a measure of the value of modern organized research, both fundamental and applied—research that will continue to be vigorously pursued, since the present stage is clearly but the threshold of vast developments.

Another comparison may be drawn in plant prototypes. The designs of graphite-moderated gas-cooled reactors at present practicable at a reasonable cost no more resemble what is already known to be theoretically possible than the early bulky reciprocating engine sets of a few hundred kW capacity and low-pressure Lancashire boilers resemble to-day's large turbo-alternators supplied with high-pressure steam from water-tube boilers.

One essential basis of engineering progress has been a progressive reduction in weight and cubic capacity in relation to plant output with a corresponding lessening of capital cost/kW. This trend will undoubtedly be followed in reactor construction. The possible lines of approach are exemplified in about 80 designs that have been proposed, which differ mainly in regard to moderators and coolants and their arrangement. The most feasible of the alternatives use heavy water as a moderator, but this is far more expensive than graphite.

The general view that nuclear power stations, apart from

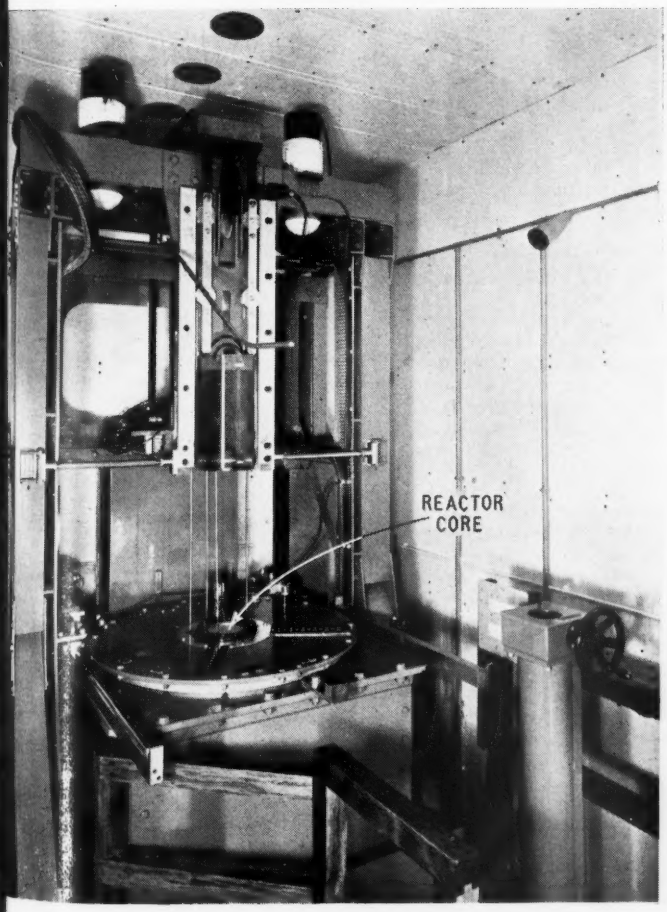
steam raising from the heat produced in the core of the reactor instead of by burning coal, would be on conventional lines, requires some qualification. An important consideration is that the temperature of the steam appears to be limited to about 600 deg F by the need to use aluminium (which is deformed at high temperature) as a container for the uranium, since it is the only metal now in commercial use that does not absorb neutrons to an extent that would break the chain reaction. The steam produced would be saturated and unless separately fired superheaters could be employed to raise temperatures considerably the thermo-dynamic efficiency would be inherently low and the life of the final rows of turbine blades would be seriously reduced. Turbines and their condensers would be physically larger and more costly, while the greater quantities of cooling water required would make more acute the problem of finding suitable power station sites, even though large ground areas would not be necessary for fuel delivery and storage and for ash disposal and emissions from tall chimneys would be harmless.

A further effect of nuclear generation would be that for economic and technical reasons the reactors would be worked at as high a load factor as possible, perhaps up to 85 per cent, entailing intermittent (e.g. two-shift) operation of the coal-fired stations. This would introduce difficulties in coping with heating and cooling cycles for large masses of metal subject to steam temperatures of 1,000 deg F and upwards when starting and stopping large sets in the present type of station.

Overall thermal efficiencies of reactors of the "thermal" type are expected not to exceed 25 per cent, contrasted with over 30 per cent achieved with some existing coal-fired stations, a figure that will be raised considerably with the intended employment of generating units of 200 to 300 MW, which will exploit more fully the thermo-dynamic potentialities of higher steam pressures and temperatures. The consequent fuel economy will be of paramount importance for probably another fifty years, during which there will be reliance on conventional methods of steam raising for meeting the major part of the demand.

Although there can be no reasonable doubt that all these drawbacks to nuclear practice will be obviated in time, any approach to finality awaits the development on a commercial scale of the "fast" reactor. In this type the speed of neutrons released by fission is not moderated to thermal level (i.e., the velocity of gas molecules in random motion at normal temperatures), which is requisite to secure fission of the proportionately few fissile nuclei of uranium. Instead, the natural 1 in 140 proportion of fissile U235 is raised artificially, thus greatly increasing the chance of fission, or else by the use of the chemically more tractable plutonium, which results from the absorption of neutrons by U238. The fast reactor has the outstanding merit of being capable of breeding more nuclear fuel than it consumes, thus avoiding the cost and complication of treating uranium ore, the resources of which are not inexhaustible. An experimental breeder reactor, "Zephyr," has been installed at Harwell to supply data for the design of a prototype power station which has been put in hand for erection at Dounreay in the north of Scotland.

"Zephyr," the zero-energy fast reactor; the top uranium reflector is raised, exposing the reactor core. (Photo by courtesy of Butterworths Publications, Ltd.)



The Immediate Aim

The determining factor in the active development of atomic energy in Great Britain is that enough coal cannot be brought to the surface to meet the annually increasing demands for power for all purposes. The immediate aim is to provide by nuclear means an electrical output equivalent to that obtainable from the burning of 5 to 6 million tons of coal by 1965 and of 40 million tons by 1970, thus limiting the amount of coal used for generating electricity to 60 million tons each year. By 1965 the generating capacity of C.E.A. power stations will be from 35,000 to 40,000 MW of which 6 to 7·5 per cent will be nuclear. In 1975 the total capacity will have become 55,000 to 65,000 MW, of which 10,000 to 15,000 will be nuclear.

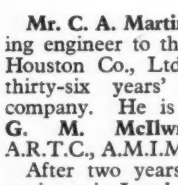
The British plan is to go ahead using the most economical methods now known, just as the pioneers in the application of electro-magnetic induction took what was available 70 years ago. Those early pioneers did not await such developments as those of the steam turbine and high voltage transmission, which they could not foresee. Nuclear scientists and engineers are better placed in having a much clearer idea of what the future is likely to bring when means of applying their continually advancing knowledge are forthcoming. Meanwhile the experience gained in initiating commercial operation of full-scale nuclear power stations will undoubtedly be of the greatest value at home and abroad and may be expected to form the basis of an important export trade.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. C. A. Martin, M.I.E.E., consulting engineer to the British Thomson-Houston Co., Ltd., has retired after thirty-six years' service with the company. He is succeeded by **Mr. G. M. McIlwrick,** B.Sc.(Hons.), A.R.T.C., A.M.I.Mech.E., A.M.I.E.E.

After two years with a consulting engineer in London, followed by nine years as chief designing engineer with J. P. Hall & Co., Ltd., Oldham, Mr. Martin joined the B.T.H. Co. at Rugby in 1919 in the D.C. Engineering Department. Three years later he was appointed design engineer in the main drawing office. In 1930 he became the company's interchange authority, being responsible for



Mr. C. A. Martin

Mr. G. M. McIlwrick

co-ordinating the exchange of technical information between the associated British companies and the associated companies overseas. He also undertook the general supervision of the Data Department at Rugby. In 1939 Mr. Martin was appointed chairman of the B.T.H. Materials Committee, and in the same year consulting engineer. In this position he was mainly concerned with external standardization and related work on many B.S.I., B.E.A.M.A., and other committees, being chairman of several of these committees.

Mr. McIlwrick received his engineering training at the Royal Technical College, Glasgow, and Glasgow University, spending vacations as a student at the B.T.H. Rugby works. He joined the D.C. Engineering Department in 1929 and subsequently was in charge of all large d.c. machine design. He designed the first 10,000 A 3,500 kW generator for electrolytic work and, during the war, machines of this type to a total of 240,000 A were installed for the production of magnesium. Mr. McIlwrick did a great deal of work on the development, in Great Britain, of electrical drives for steel mills, and visited the United States and Canada in 1948 to study American practice. The machines subsequently designed by him for the Steel Company of Wales' high-speed, five-stand tandem cold-strip mill at Trostre incorporated an entirely new type of low inertia armature and constituted the first high-speed strip mill drive to be installed in Europe. Mr. McIlwrick takes over Mr. Martin's work on standardization, committee representation, and interchange of information, and has been elected to the British National Committee of the International Electrotechnical Commission.

Mr. A. N. Savage, M.I.E.E., electrical engineer superintendent of Royal Mail Lines, has been appointed by the Council of the Institution of Electrical Engineers to serve in a personal capacity on the Committee of Regulations for the Electrical Equipment of Ships, which serves also as the United Kingdom Committee for Technical Committee No. 18 of the International Electrotechnical Commission.

Mr. A. D. Busby, B.Sc., A.I.M., who has been a member of the Development and Research Department of the Mond Nickel Co., Ltd., for eighteen years, latterly as development metallurgist on alloy and special cast irons, has resigned his position, and from 1st September next he is taking up the post of deputy process development manager of the Titanium Department, I.C.I. (Metals), Ltd., Witton, Birmingham.

Major W. F. F. Scott, M.C., director of training and welfare of Tube Investments, Ltd., will retire from the board and relinquish his appointments within the company on 31st July on reaching the retirement age.

A silver tea service and salver have been presented to **Mr. W. Winwood,** manager of the Shropshire and Herefordshire Sub-Area of the Midlands Electricity Board, whose marriage we reported in our last issue. The gifts were subscribed for by employees in the Sub-Area and the presentation was recently made by the Sub-Area engineer, Mr. G. Newey.

In our last issue we gave the names of those who will fill the vacancies on the Council of the Institution of Electrical Engineers for the ensuing year, and included the portraits of some of them. We now reproduce photographs we have since received of **Professor H. E. M. Barlow,** B.Sc.(Eng.), Ph.D., **Professor J. Greig,** M.Sc., Ph.D., and **Mr. D. McDonald.**

Prof. H. E. M. Barlow

Prof. J. Greig

Mr. D. McDonald

Mr. B. C. Sendall, C.B.E., has been appointed deputy director general of the Independent Television Authority. Mr. Sendall has been an assistant secretary in the Admiralty.

Mr. W. E. Miller, M.A.(Cantab), general manager of the Trader Publishing Co., Ltd., and managing editor of *Wireless and Electrical Trader,* was the guest of honour at a dinner given recently by the British Institution of Radio Engineers. The function, held at the Savoy Hotel, London, marked the retirement of Mr. Miller as the Institution's president, an office which he had held for two years. The gathering was presided over by his successor, Rear Admiral Sir Philip Clarke, K.B.E., C.B., D.S.O., and was attended by a large and distinguished assembly including Admiral the Earl Mountbatten of Burma, K.G., who held the office in 1947-48, and Countess Mountbatten.

Mr. A. G. C. Lloyd and **Mr. M. L. Miller** have resigned from the boards of some of the subsidiary companies of the Bowthorpe group so as to be able to devote more time to the affairs of the Holdings company. The following directors have been appointed:—**Mr. N. L. Keen** (Bowthorpe Engineering Co., Ltd., and Cheltenham Plastics, Ltd.); **Mr. M. Bernheim** (Hellermann, Ltd.); **Mr. H. R. Whyte** (Hellermann, Ltd.); **Mr. C. E. D. Catley** (Cheltenham Plastics, Ltd.); **Mr. A. R. Mason** (Bowthorpe Engineering Co., Ltd.).

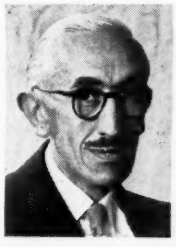
Major C. J. P. Ball, D.S.O., M.C., who has held the position of chairman and managing director of Magnesium Elektron, Ltd., from the company's formation in 1934, has relinquished the latter appointment in favour of **Dr. C. J. Smithells,** M.C., but remains chairman of the company. **Brig. A. G. Cole,** O.B.E., previously assistant managing director, has been

appointed commercial director. **Dr. S. J. Fletcher** remains technical director.

Mr. **H. Dunlop** and **Mr. C. E. H. Eckersley,** M.I.Mech.E., M.Inst.F., have been appointed directors of Davidson & Co., Ltd.

The London Electricity Board has appointed **Mr. J. A. Wedgwood,** M.A., A.C.I.S., as deputy secretary, from 12th September next. Mr. Wedgwood, who is at present an administrative officer in the committee and general administrative branch of the Secretary's Department, Central Electricity Authority, succeeds Mr. F. G. S. Dangerfield, C.A., who recently retired. Mr. Wedgwood was educated at Monkton Combe, and later at Queen's College, Cambridge, where he attained second class honours (historical tripos) in arts. During the last war he served as a signal officer with the Durham Light Infantry in North Africa, Sicily and North-West Europe. Commencing his business career as assistant principal with the Ministry of Fuel and Power in 1946, Mr. Wedgwood joined the British Electricity Authority just before vesting day, and was personal assistant to Mr. H. F. Carpenter, C.B.E., F.C.I.S., F.S.A.A., secretary of the Authority, for a period of two years, before taking on his present duties working under Mr. W. G. S. Thompson, O.B.E., assistant secretary.

Mr. A. R. Yates has been appointed sales manager of E. Dawson (Lamp Factors), Ltd. Before 1939 Mr. Yates served with T. Clarke & Co., Ltd., joining the R.A.S.C. in 1940. In 1942 he transferred to the Royal Electrical and Mechanical Engineers, with which corps he attained the rank of major. On release from military service Mr. Yates joined E. Dawson (Lamp Factors) as a representative, subsequently being appointed manager of the company's branch at Chatham, from whence he joined the Whitworth Electric Lamp Co. in 1953.



Mr. A. R. Yates

An award for courageous action was made on 22nd July by Mr. C. T. Melling, C.B.E., chairman, Eastern Electricity Board, to **Mr. Dennis Smith** (34), of St. Ives, Huntingdonshire, an installation inspector at the St. Ives and Hunts Branch of the Fens Sub-Area. Mr. Smith's prompt action, in face of considerable personal danger, in dealing with an oil fire and explosion at the St. Ives substation shortly after midnight on 9th June this year, saved further damage to equipment and the building. With great presence of mind and in the dark he unlocked the substation and put out the oil fire. Although burned he carried on through the night, giving every assistance he could to the engineers in getting the electricity supply restored.

Mr. D. Smith receiving a cheque from Mr. C. T. Melling. On Mr. Smith's left is Mr. H. C. Waters, deputy chairman, Eastern Electricity Board

Mr. M. R. Gavin, head of the Department of Physics and Mathematics at the Birmingham College of Technology, has been appointed Professor of Applied Electricity at the University College of North Wales.

Mr. W. Fishwick, lecturer in electrical engineering in Edinburgh University, has been appointed to the newly established Chair of Electrical Engineering at the University College of Swansea.

Mr. N. A. Richardson, B.Sc., A.R.I.C., has been appointed technical adviser to the Association of Tar Distillers. He will devote much of his time to wood preservation, in which he has had a long and very wide experience. He has been a member of the staff of the Forest Products Research Laboratory since 1929 and for many years has been in charge of the section dealing with wood preservation.

The Earl of Swinton has been appointed a director of Broadcast Relay Service, Ltd.

Mr. L. N. B. Donald, A.M.I.E.E., senior assistant commercial engineer at the Central Gloucestershire Sub-Area headquarters, Gloucester, of the Midlands Electricity Board, has been appointed manager of the Board's Forest of Dean District, with headquarters at Lydney. He succeeds Mr. J. Blackburn, who relinquished the appointment recently on reaching the retiring age. The appointment takes effect on 1st August. Mr. Donald received his early training at Faraday House and gained an honours diploma. He then joined Johnson & Phillips, Ltd., as assistant engineer responsible for development in the area of the subsidiary Westmoreland & District Electricity Supply Co., remaining in this post until the outbreak of war in 1939. During the war Mr. Donald served with the Indian Army and on demobilization with the rank of major he joined the staff of the West Gloucester Power Co. as assistant district mains engineer at Lydney, retaining a similar appointment with the Midlands Electricity Board on nationalization of the industry. In 1951 he was promoted second assistant engineer in the mains department at the Board's Central Gloucestershire Sub-Area headquarters, returning to Lydney in 1952 as district engineer. He took up his present position in 1953. Mr. Donald has been an active member of the Electrical Power Engineers' Association, and served last year as vice-president of the Association, also being a member of the National Joint Board.

Mr. G. H. Dowty has been appointed a director of Remploy, Ltd. He is chairman of Dowty Equipment, Ltd., Cheltenham.

Mr. T. H. Batchelor, hon. treasurer of the Sussex Centre of the **Electrical Industries Benevolent Association,** informs us that the total amount collected on behalf of the Association during the recent British Electrical Power Convention at Brighton was £127 10s. He expresses his thanks to exhibitors who gave prizes.

The London Area Finals of the **Electrical Industries National Golf Championship** took place at the Berkshire Golf Club, Ascot, on 14th July and seventy-five players from the industry took part. In the morning, for the medal round, Mr. D. J. Scott had the best scratch score and becomes the holder of the Brooking Cup, the next best scratch score being returned by Mr. R. Westcott. The Sir Leonard Pearce Cup for the best net score went to Mr. J. E. Tyce; the runner-up cup was won by Mr. K. J. Curwen, who tied with Mr. L. A. Bull and the award of the cup was made on the best last nine holes. In the afternoon Mr. J. S. Foggett and Mr. F. Cooley won the greensome Stableford competition, followed by Mr. I. McDonald and Mr. D. M. Barr. In the evening Mr. E. A. Mills, the chairman of the London Committee, presented the prizes.

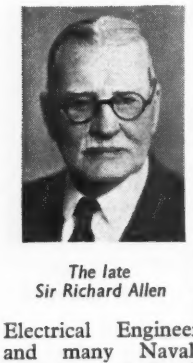
Mr. John Henshaw has been appointed technical liaison officer for the technical organization of Oliver Pell Control, Ltd., in the north of England.

Mr. S. H. Reece has been appointed manager of Cobra (Wood Treatment),

Ltd., as from 1st August. For the past twenty-two years he has been with William Geipel, Ltd., having been responsible during recent years for their cable sales.

OBITUARY

Sir Richard Allen.—A memorial service to the late Sir Richard Allen, C.B.E., D.L., chairman of W. H. Allen, Sons & Co., Ltd., whose death was reported in our last issue, was held on 21st July at St. Paul's, Bedford. The Rev. J. H. King officiated. The large congregation included Mr. H. W. Thomas (Department of Electrical Engineering, Admiralty), and many Naval representatives, Rear-Admiral D. J. Hoare (British Internal Combustion Engine Research Association), Major-Gen. A. E. Davidson (Institution of Mechanical Engineers), Dr. S. F. Dorey (chief engineer surveyor, Lloyd's Register of Shipping), Mr. R. H. Marks (Federation of British Industries), Mr. T. D. Abbott (chairman, Engineering Employers' Association), Mr. E. Smith (Engineering and Allied Employers' National Federation), and the Mayor of Bedford and members of the Corporation.



The late Sir Richard Allen

Ald. G. T. Spaven.—The death occurred in hospital at Hull on 22nd July, at the age of fifty-six, after an operation, of Alderman George Thornton Spaven, electrical contractor, of Bridlington. Alderman Spaven was a member of the Electrical Contractors' Association, and was Mayor of Bridlington during Coronation Year.

Mr. W. H. Cooke, M.I.E.E.—The death occurred on 22nd July at Hart Hill, Luton, Beds, of Mr. Walter Henry Cooke; he was eighty-five. Mr. Cooke, who became an associate of the Institution of Electrical Engineers in 1896, an associate member in 1899 and a member in 1931, was borough electrical engineer of Luton until his retirement in 1939.

WILLS

Mr. D. Macadie, M.B.E., inventor of the "Avometer," and of coil-winding machines, who died on 13th February last, left £5,940 gross (£5,880 net).

Mr. F. D. Frank, late joint managing director of Watts Fincham, Ltd., who died on 8th April, left £25,354 gross (£22,640 net).

Mr. I. I. Jones, M.I.E.E., retired divisional chief engineer, National Coal Board, South Western Division, who died on 5th January last, left £22,186 gross (£21,992 net).

Mr. C. H. H. Downing, A.I.E.E., M.I.P.E., principal of Downing and Partners, consulting engineers, who died on 6th March last, left £10,856 gross (£2,770 net).

Mr. A. Sinclair, managing director of the Craigpark Electric Cable Co., Ltd., who died on 1st March last, left personal estate in England and Scotland valued at £3,484.

THE G.E.C. REPORT

The report and accounts of the General Electric Co., Ltd., for the year ended 31st March last, which were issued on Monday, show a considerable rise in the aggregate profit of the group. The profit on trading was £9,889,324, as compared with £8,264,047 for 1953-54, and after adding income from investments, and deducting depreciation, loan interest and other charges, the aggregate profit before taxation was £7,538,966 (against £5,777,918). The net profit attributable to the holding company, after taxation, was £3,452,546 (£2,364,345). United Kingdom taxation absorbed £3,636,389, overseas taxation £357,796, and the profit attributable to minority shareholders in subsidiary companies £92,235. To the net profit is added £4,139,622 brought forward from the previous year, and £328,524 net profit relating to previous years, making £7,920,692 available. Appropriations include £1,051,475 to general reserve, and £750,000 transferred to reserve for increased cost of plant replacement. It is proposed to pay a final dividend on £13,714,680 ordinary stock of 9½ per cent actual, absorbing £749,165. An interim dividend of 4½ per cent actual was paid on £11,755,440 ordinary stock, which absorbed £290,947. For the previous year the total distribution on £11,755,440 ordinary stock was 12½ per cent.

Sir Harry Railing (chairman and joint managing director) says in the report that the substantial increase in profits has been achieved in spite of increased wage costs which the company has been unable to recover fully in the selling prices. The good result is due to increased turnover achieved both in capital and consumer goods and greater efficiencies arising from the plant modernization programme. This increased turnover has been achieved with only a slight increase in the stock and work in progress.

Total exports did not quite reach the record figure established for the previous year. Expansion in overseas markets becomes increasingly difficult in view of keen competition, import restrictions and local manufacture. The overseas companies have, however, shown a slight increase in profits on the previous year. The order book at the end of the financial year, both for consumer and capital goods, was satisfactory, but the position with regard to certain consumer goods at home has since become less favourable owing to the measures taken by the Government to curb internal spending.

Indian Railway Order for B.T.H.

The British Thomson-Houston Export Co. has obtained an order through A.E.I. (India), Ltd., worth approximately £300,000 for converting plant, d.c. switchgear, and control gear for the first stage in the main line electrification of the Eastern Railway of India. The order covers six substations and three track section cabins on the main line from Calcutta (Howrah) to Burdwan, a distance of sixty-six miles, and one track cabin at Karmarkundu, which is on the branch line to Tarakeswar.

The converting plant consists of eight 2,500 kW and four 3,000 kW, 3,000 V, 12-phase pumpless steel-tank mercury arc rectifier equipments, each including two withdrawable truck-mounted rectifiers, an outdoor transformer and a control cubicle. These are to be installed in the two triple-unit, two double-unit and two single-unit substations. The d.c. switchgear for the rectifiers, track feeders and track sectioning cabins comprises high-speed circuit-breakers which, with their associated control gear, are mounted on withdrawable trucks. The order also includes l.v. switchgear and certain substation auxiliaries.

South African Tariff Applications

The South African Board of Trade and Industries has received applications for increased duties on (a) luminous tube transformers and (b) electric accumulator batteries imported separately or as parts of motor vehicles or tractors. Interested United Kingdom firms should get into touch with their trade organizations, which have been informed of the applications. Inquiries from firms which wish to make independent representations or need further information should be addressed to the Commercial Relations and Exports Department of the Board of Trade, Horseguards Avenue, Whitehall, S.W.1, quoting (a) C.R.E. 7878/55 or (b) C.R.E. 7831/55.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £171 0s 0d
COPPER, H.C. Electro	ton £365 10s 0d
Fire Refined 99·70%	ton £364 0s 0d
Fire Refined 99·50%	ton £363 0s 0d
COPPER Tubes ..	lb 3s 4⅜d
Sheet	ton £420 5s 0d
H.C. wire and strip ..	ton £396 5s 0d
LEAD, English ..	ton £108 5s 0d
Foreign	ton £107 0s 0d
MERCURY	flask £108 0s 0d
TIN, block (English) ..	ton £767 0s 0d
ZINC, G.O.B. Foreign	ton £91 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 8½d
Sheet	ton £331 0s 0d
Wire	lb 3s 3½d
PHOSPHOR BRONZE Wire	lb 4s 11½d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 38½d—39½d

PARLIAMENTARY REPORT

Sources of Raw Materials

IN the House of Commons last week Mr. R. A. Butler, Chancellor of the Exchequer, replying to Mr. Frederick Lee, said that the materials which the sterling area drew wholly or in substantial proportion from dollar sources included aluminium, nickel, molybdenum, sulphur, synthetic rubber and manila hemp. There were also large imports of cotton, softwood, woodpulp, paper and copper. One-third of our imports of raw materials from the non-sterling world were from dollar sources. New sources of supply were continually being developed and the extent to which U.K. importers had been given freedom of choice of sources had progressively increased.

Mr. Lee asked if the Chancellor was satisfied with our trade with Canada. Would he agree that if we were going into the age of automation before long, we should find that the absorption rate of raw materials in the world would be far greater than now? He asked the Government to step up the geological survey in Britain and the Colonies and to find more geologists, technologists and people of that type.

Mr. Butler replied: "The Government have given attention to this very important question. We are in process of seeing what alternative sources of supply there are."

Capital Development Programmes

Answering questions by Mr. Woodburn the Chancellor of the Exchequer said there would continue to be very close contact between the Government and the Boards of the nationalized industries regarding their programmes of essential capital development. He was aware that investment in power stations was more important than investment in certain other aspects of the C.E.A. programme, but he was certain that the various national Boards had the priorities well in mind.

Sir Herbert Butcher inquired whether the Chancellor would ask the electricity undertakings not to borrow on short-term from the banks so as to lend on hire purchase and Mr. Butler replied: "We shall have to see about that."

Nationalized Industries as Monopolies

Mr. Eric Johnson asked the President of the Board of Trade if he would introduce legislation to enable him to include the nationalized industries and the restrictive practices of trade unions among the subjects which might be investigated by the Monopolies Commission.

Mr. Peter Thorneycroft said that so far as a nationalized industry was a monopoly, it derived that status from an Act of Parliament, which could not properly be the subject of investigation by the Commission. So far as a nationalized industry participated in practices investigated by the Commission which did not derive from a statutory monopoly, no special legislation appeared to be called for. Questions about legislation affecting trade unions were not for the Board of Trade to answer.

Air Pollution

Mr. Ellis Smith asked the Minister of Housing and Local Government what steps had recently been taken to minimize air pollution throughout the country.

Mr. Sandys replied that he hoped shortly to introduce a Bill to give effect to the Beaver Committee's principal recommendations.

Atomic Energy Questions

The Minister of Works (Mr. Birch) told Mr. James Hutchison that the International Conference on the Peaceful Uses of Atomic Energy to be held in Geneva from 8th to 20th August was being held under the auspices of the United Nations Organization. The proceedings of the conference would be reported in the Press and would be published in full.

Mr. George Strauss asked the Minister of Works whether, in view of the proposal of the United States Atomic Energy Commission to declassify a considerable amount of information, the Atomic Energy Authority intended to take similar steps and to what extent it was intended to act in agreement.

Mr. Birch said that declassification was carried out by agreement between the Atomic Energy Authority and the United States Atomic Energy Commission, and any announcements would be made simultaneously.

Scientists and Technologists

Mr. Frederick Lee asked the Parliamentary Secretary to the Ministry of Works what was the annual rate at which we were producing scientists and technologists and what proportion of them were using their knowledge either in teaching or in industry.

Mr. Bevins said the number of first degrees, Higher National Certificates and equivalent qualifications given in science and technology at the universities and technical colleges in Great Britain last year was about 17,000. This included about 5,500 university degrees in pure science and mathematics. No precise figures were available as to the proportion of such persons using their knowledge in teaching or industry. About one-quarter of the new graduates in pure science eventually taught in schools or universities and at least one half went into industry. Most technologists, of course, found jobs in industry.

Private Generating Plant

Mr. Nabarro asked the Minister of Fuel and Power what estimate he had made of the aggregate capacity of private and independent generating plant and to what extent this was working in parallel with the grid.

Mr. Geoffrey Lloyd said the amount was about 4½ million kW. Information was not available about the extent to which this was working in parallel with the grid.

Trade with Soviet Bloc

The Minister of State (Mr. Low) informed Mr. Harold Davies that the ban on the export of copper wire was lifted on 16th August in the case of exports to the Soviet bloc. The ban on copper wire had not been re-imposed, but there were bans on the export to the Soviet bloc of copper wire rod, and on coaxial, multipair and submarine cable.

Mr. Warbey asked the President of the Board of Trade what additions to or reductions from the embargo list applying to trade with the Soviet bloc had been made since the list was revised in October, 1954.

Mr. Thorneycroft replied that there had been added certain classes of turbines and parts, certain communication cables and cable-making machinery and transmission equipment and some types of aircraft refuelling apparatus. Certain dielectric dryers, some types of generating equipment and certain microflash apparatus had been freed from embargo. Details would be published in the *Board of Trade Journal*.

Automatic Processes in Industry

Replying to Mr. Frederick Lee, Mr. Kaberry, Parliamentary Secretary, Board of Trade, said that the Department of Scientific and Industrial Research was at present carrying out a study to discover the extent to which automatic processes have been and were likely to be introduced in industry. It was hoped that an interim report would be published in the autumn.

Copper Prices

In reply to Mr. Ellis Smith, the President of the Board of Trade (Mr. Peter Thorneycroft) said that the price of copper wire bars in this country was £62 a ton in 1945; it rose by stages to £98 during 1946, and at the date of de-control (4th August, 1953) it was £252. The prevailing price of ½in copper tube to British Standard 18 gauge at the end of 1933 was £84 per ton and at the end of 1936, 1940, 1942 and 1954, respectively, it was £105, £131, £180 and £408.

Technical and Scientific Education

THE British educational system is to be re-shaped, with the co-operation of industry, in order to provide the extra scientists, technologists, technicians and craftsmen who are needed to keep Great Britain ahead of the rest of the world in the scientific revolution now taking place.

This was the theme of the important speech made by the Minister of Education, Sir David Eccles, in the House of Commons debate on technical and scientific education last week. The aim of the plan, which he said would be worked out during the summer recess and would be fully revealed before Christmas, would be to provide a broader route than that which now led to the universities along which young men and women could rise—according to their abilities—to the top ranks of science or industry.

The debate was initiated by Mr. Austen Albu, who quoted Mr. S. E. Goodall, vice-president of the Institution of Electrical Engineers, as saying at the recent British Electrical Power Convention that the position was acute and was likely to become worse. He had warned that "new projects will be seriously retarded and some even abandoned if no solution to this problem can be found." The Institution of Production Engineers had estimated that we needed to double the number of production engineers of professional or graduate standard in the next ten years.

Mr. Albu said the Minister of Fuel and Power had admitted that the nuclear power station programme was held back by the shortage of scientific and technical staff. The same thing was taking place in the coal industry. The rapid expansion of electricity generation, by whatever means, was bound to need more skilled professional engineers and technicians.

Alternative to Academic Route

Sir David Eccles said that when he examined the critical shortage of scientists and technicians he found the most urgent job that had to be done was one of public relations; not nearly enough effort was being made to fire the imagination of children, their parents, their teachers and their employers with the adventure of the scientific revolution. The time-honoured way to the highest qualifications in science and technology had been through the independent schools and grammar schools to the universities. University education was to be expanded but this academic route would still be far too narrow to carry the numbers required to push forward the frontiers of science and engineering. It was therefore necessary to construct an alternative and much broader route than that which led to a university degree.

At the moment he could only give a sketch of the new plan. All boys and girls would be given an opportunity to go as far as their abilities and enterprise would take them, and at each stage in the progress towards the highest distinctions there would be young people leaving technical colleges for industry, and others coming from industry to the colleges. He wanted the new route to have plenty of exits and entrances all the way along. The Government would invite individual firms or industries to tell what vocational courses they wished the Government to provide. In the new system all children who were not able now to climb on to the university ladder by means of the conventional examinations, would not be debarred from the chance of gaining the top prizes in life. The alternative route would be through technical institutions, the most numerous being local colleges which would offer day-release, evening and full-time courses—suited to local industries—leading to such awards as the Ordinary National Certificate and Diploma. Beyond this, there would be colleges in which students could qualify for awards in technology up to university standard.

Electrical Manufacturing Example

The cost of hostel accommodation and heavy running costs made it necessary for them to establish these colleges at strategic points in conformity with the needs of industry. For example, the General Electric Co. was asking the Ministry to build up courses for its employees in Birmingham; that company had employees in other places and naturally wished to give them the same opportunities. Establishing a residential college was the only way the Ministry could meet their needs. As far as possible the local technical colleges would bring the education to the students, whereas the advanced colleges would find that most of their students would travel to the education.

Evening and day-release courses served well to train technicians but obviously they were not sufficient for the advanced training of the technologist. Boys leaving school at 18 with the "A" level of the G.C.E., together with those who had left school earlier but kept up their studies at a technical college, would be recruited as student apprentices for "sandwich courses" of four to five years. These students would spend alternately six months in a college and six months in a works. The courses would be designed to suit the needs of industry, no two schemes being the same. The content of mathematics, science and engineering subjects would not differ strikingly from a university syllabus.

New Award

No existing award would be suitable for students of the advanced courses. He had therefore accepted the recommendation of the National Advisory Council for Education for Industry and Commerce, that a new award should be instituted. Lord Hives, chairman of Rolls-Royce, would be chairman of the new award-making Council, whose job would be to approve the syllabuses, the conditions of teaching, the qualifications of the teachers and the examinations in these regional colleges, as well as the granting of national awards.

Until there were more science students there would be a shortage of teachers. It was therefore of great importance that industrial managements should help out by lending part-time teachers from their own staffs.

In conclusion, he reminded the House of the importance of giving scientists a knowledge of the humanities and the arts, so necessary if we were to remain civilized and contribute to the right use of the new power which men were gaining over nature.

In the debate which followed Mr. Airey Neave, who said he was particularly interested in the atomic energy industry, revealed that there was an apprenticeship scheme in the industry, begun in a small way, which involved only 400 young men. But it would require the help of the Ministry of Education in providing outside day-release courses near the atomic energy establishments now being created. In connection with Dounreay, Harwell and one or two other plants, the Minister might collaborate with the Lord President of the Council to get an expansion of the apprenticeship scheme.

Views of Engineering Institutions

Mr. Arthur Palmer, when the Minister was speaking, had intervened to point out that in making arrangements for the new national award there were differences of opinion between the Ministry of Education and the engineering institutions, such as the mechanical, electrical and civil engineers. Sir David Eccles replied, "I hope that we shall secure their co-operation. We must remember that this argument has gone on for more than three years and has done much damage to British industry. It is time we made a firm start in one direction. My conversations with the professional bodies mentioned show that they may have been under a misapprehension. Perhaps it has largely been my fault. I do not think they understood how completely free the award-making Council will be to set high standards and to see that they are maintained."

Now speaking in the debate, Mr. Palmer said he was wondering what was to be the future status and standing of the Higher National Certificate now that the new award was coming along. When introduced, the Certificate was intended to be a technician's qualification, but very soon it lost that

lower quality and was used by many as a way into membership of the professional engineering institutions. For a number of years it had been essentially a technologist's rather than a technician's qualification. In future, was the Certificate to be entirely superseded by the new award, or would it revert to its original lower standard of a technician's qualification?

Replying to the debate for the Government, Mr. Henry Brooke, Financial Secretary to the Treasury, said the Minister of Education was already in touch with the Atomic Energy Authority on the matters mentioned by Mr. Neave. The Minister would reply to many other points by letter. He went on to give fuller details of the building schemes in London and in provincial cities to increase the facilities for technological education which were first announced in December last year. The development of the Imperial College of Science and Technology at South Kensington would cost £15 million, he said, and much of the building work was already in progress. The cost of the schemes outside London would be £6 million with an extra £520,000 a year for maintenance. A further set of projects was in the planning stage.

Hire-Purchase and Capital Expenditure

Chancellor of the Exchequer's Statement

WHEN the Chancellor of the Exchequer, Mr. R. A. Butler, announced the Government's decision to intensify hire-purchase restrictions and reduce capital spending in order to correct a deteriorating balance of payments situation he said that the postponement or slowing down of capital expenditure by the nationalized industries would be carried out without jeopardizing essential objectives, such as the development of nuclear power and coal production.

Referring to nationalized industries, he said, "The House must remember that the services which they provide are basic to the whole of the economy and that serious damage could be caused to industry as a whole by inadequacies in the supply of transport and of power. Nevertheless, in response to the Government's request, certain of the capital requirements of the nationalized industries will be reduced in the immediate future in two ways. First, expenditure on capital projects will be postponed or slowed up as far as may be possible with due regard to contractual obligations and economical administration. Secondly, these industries will—so far as practicable—increase their internal resources which are available for capital purposes, as indeed the Central Electricity Authority have already publicly announced is their intention."

He said that since the Government imposed restrictions on hire-purchase on 24th February he and the President of the Board of Trade had watched the effects closely. Their object was not to depress the sales of particular goods because they were regarded as less essential or more readily exportable, but to relieve the pressure on home demand generally by asking the consumer to use more of his own income and less borrowed income when he bought the goods of his choice. He and the President had reached the conclusion that the measures taken in February must now be intensified. The President had therefore made an Order, to operate from 26th July, to increase from 15 to 33⅓ per cent the minimum deposit required in certain transactions, of which the most important were those involving motor-cars and motor-cycles, radio and television sets, gramophones, cameras, and certain domestic appliances, such as refrigerators, washing machines, vacuum cleaners and gas and electric fires. The maximum repayment periods would remain unaltered.

Referring to the financial position generally, the Chancellor said the nation was at present absorbing too much of our production at home. Our success in increasing production and our very prosperity required increased imports which, in turn, must be paid for by increased exports. Sufficient extra exports, however, were not yet forthcoming. The recent strikes had undoubtedly set our export trade back considerably and some of the set-back would prove to be permanent loss, thus adding to the efforts we had to make. Generally, we could not be satisfied with the way in which our balance of payments and our reserves were moving. The Government regarded the period in front of us as being one of hard work and consolidation to strengthen the home front before we made any further forward move on the exchange front.

For the time being our primary aim must be to reduce home demand in order to leave room for the extra exports we needed. All must try to spend less in order to save more. Business firms should endeavour to slow down investment not of the greatest national urgency. Since the principal object was to improve our balance of payments, it would be undesirable to check investment leading to increased production for export. For the rest, even though a high level of productive investment was undoubtedly in our long-run national interest, all those embarking on investment projects should consider whether they could not postpone their initiation, irrespective of whether they financed them from their own resources or by borrowing.

Details of Hire-Purchase Restrictions

Following the announcement by the Chancellor of the Exchequer, the Board of Trade has made an Order (Hire Purchase and Credits Sales Agreements (Control) (Amendment) Order, 1955 (S.I. 1955/1130), H.M. Stationery Office, price 3d), which increases the minimum initial deposit from 15 to 33⅓ per cent for certain classes of goods as from 26th July. Among the radio and electrical goods affected are radio receiving sets and television receiving sets (including portable sets and sets designed for use in road vehicles), whether or not assembled and whether or not complete; television aerials and cathode ray tubes; radiogramophones and record players; domestic space heating appliances, excluding solid fuel appliances; dish washers; drying cabinets; washing machines and washers, excluding washing machines and washers which are designed for heating water by electricity or gas but which are not otherwise designed for operation by electricity or gas; ironing machines and irons; wringers and mangles; pressure cookers; floor polishers; vacuum cleaners; refrigerators with a storage capacity not exceeding 12 cu ft; machines for mixing, extracting and preparation of food and drink; electric kettles and other cooking utensils incorporating heating elements, including electric hot plates; dry shavers, electrically operated; sewing machines; and hair drying machines.

The classes of goods for which the deposit remains at 15 per cent include cookers, water heaters and wash boilers. Other changes are that an agreement may now include both goods specifically controlled under the Order and other goods. In such a case, however, the other goods in the agreement are brought within the scope of the Order, the terms prescribed for them being the lowest deposit and longest payment period for any controlled goods in the same agreement. If an agreement provides for payment in a shorter period than the maximum allowed by the Order it may subsequently be altered to extend the period up to that maximum. The amount of any allowance for goods taken in part exchange which may be taken into account in calculating the deposit, must be reasonable in relation to the value of such goods.

VIEWS on the NEWS

By REFLECTOR

ALTHOUGH the increases in electricity tariffs now being announced are obviously the direct result of the latest rise in the price of coal, there have been the usual attacks on the industry, which has been accused of "excessive expenditure and wasteful administration." Those who argue in favour of competition in private industry, by some strange reasoning contend that it is wasteful when applied to gas and electricity. One correspondent in a Scottish paper goes even further. After complaining of the thousands of pounds spent by the Electricity Boards on new showrooms and saying that the Gas Board has done the same and the Coal Board "has built palaces where the running costs are prohibitive," he takes in the Post Office in his castigation:—

> "A glaring example is the provision of motor bikes for the telegraph service. There is hardly a spot in our own town which could not be reached in a few minutes on a push bike, yet we must have motor bikes. No wonder the telegram price was doubled."

* * *

It is said that one can get used to almost anything, but in my case at least the nerve-racking sound emitted by the average works siren is an exception. I was interested, therefore, to read a letter on the subject in the *Evening News* last week. A correspondent had asked what it would be like if employers pealed bells to call their staffs to work, and Mr. W. Glass, who is joint managing director of Johnson & Phillips, Ltd., wrote to say that his company had been doing this for seventy-five years. The bell used weighs half a ton and is pealed by hand four times a day for half a minute to a minute. I suppose by now it is no longer a legitimate excuse for a worker to say he thought it was Sunday.

* * *

A new electrical application on the farm is reported from Norfolk. According to the *Eastern Daily Press*, a fruit farmer at Saxlingham Thorpe has devised a system of rattles in his cherry orchard to reduce the depredations of birds. The rattles are sounded automatically at intervals from 5 a.m. to 8.30 p.m., power being obtained from a small wind-driven generator mounted on a 40ft tower which charges a 24 V battery. Although deprived of a meal, the birds benefit too, for previously the farmer employed a number of guns to protect his crop, at a cost of £5 a day. As the birds may become accustomed to the rattles, the farmer is said to be experimenting with "other devices" and if neighbouring fruit farmers enter into friendly competition the results should be startling.

* * *

In nearly every case electrical equipment was chosen by readers of a daily newspaper who replied to the question: "What three things does a housewife want most?" The first selected a floor polisher, a refrigerator and a steam-electric iron in that order; the second a water heater, a washing machine and a refrigerator; and the third a refrigerator, an electric mixer, and a cooker with a time switch. Apparatus chosen by other readers included a clothes drying cabinet, an automatic ironer, a press-button garbage destroyer, an electric hair dryer and an electric dish-washer. It is interesting to compare these replies with the results of a competition organized by the Auckland Electric Power Board in New Zealand. There, from 7,000 entries, the prize-winning combination proved to be an electric iron, a radiator and—strangely—a jug.

* * *

It is reported that the Irish Electricity Supply Board has decided to suspend the sale of oysters, of which some 90,000 were taken from the Shannon Estuary at the end of the last season and sold at almost £2 a hundred. To relieve the fears of those who have a penchant for this particular delicacy it should be made clear that the suspension will be of a temporary nature only. Experiments are being carried out to check the future oyster cultivation in the estuary and if these prove successful the oyster industry in the area will be put on a scientific footing to help it to play a bigger part in the Board's revenues.

* * *

At a meeting of the Farnhill Parish Council, reported by the *Craven Herald and Pioneer*

> "members expressed their appreciation of the lighting in the Culvert since the Electricity Board completed their conversion. It was decided to send a letter of thanks to the district manager to this effect, and suggest that the wattage of the lamps be slightly reduced."

This seems to be gratitude tempered by a striving after undue economy.

* * *

Unkind remarks about an electric hair-brush and other "inventions" of a Mr. Charles Klein in an earlier issue evoked the following letter from Mr. Klein in the *Electrical Review* of 2nd August, 1895:—

> "The enclosed paragraph has been handed to me, and if your journal had a wide circulation amongst the society with whom I deal, I would challenge you for a sum of money for a charitable purpose to have made some incorrect statements as far as I am concerned, also about my new electrical appliances, batteries, &c., but for the present, until I shall have seen you, I can only say I am very surprised a gentleman holding your position to condemn some new inventions that he has not seen. I can understand you are surprised that a hair dresser has invented several electrical batteries, apparatus, &c. I am very fond of electricity, not only for medical purposes but in all its branches. I have fitted alone my establishment with 52 lamps, telephone, bells, alarms, &c., and I have received the best compliments from first class electrical engineers and inspectors on completion of the work. My electro-prophylactic batteries and brushes are made entirely upon new scientific principles, and are in the hands, and recommended by, some of the best doctors of Harley Street, &c. At your convenience, I will be most happy to show you, by appointment, in my establishment or at your office, some novelties and inventions I can claim as my own."

Superheat Boost

Starting Boilers After Overnight Shut-Down

A NEW form of superheat boost has been evolved by John Thompson Water Tube Boilers, Ltd., to safeguard large turbo-generator sets by ensuring the correct temperature of steam during the period of starting-up of boilers after overnight banking or emergency shut-down. This new system employs hot gases derived from burning oil fuel in special gas turbine burners or "combustors." Trials have been carried out at the company's experimental station, and the system is to be used in the first two of eight 550,000 lb/hr Thompson boilers in the Central Electricity Authority's Marchwood generating station.

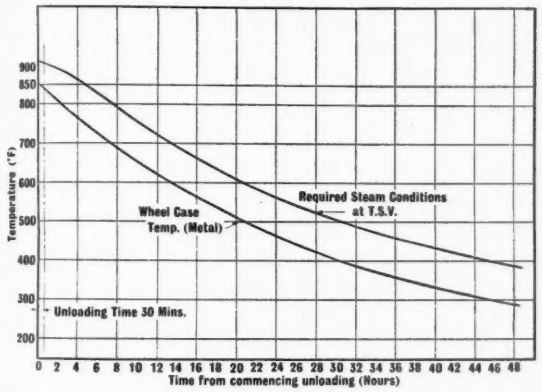


Fig. 1.—Curve showing relationship between length of shut-down and steam temperature at t.s.v. on start up for inlet steam conditions of 900 deg F

The system will also be put into operation in the first three of six 575,000 lb/hr boilers in the Tilbury generating station.

One of the major problems of two-shift operation is that the shut-down turbines on large high-temperature generating units are still at high temperature during the period when the normal steam temperature from the superheaters, under conditions of reduced boiler load, is considerably lower. Severe temperature shocks are therefore liable to occur when commissioning the turbine following such periods of two-shift operation or short-term shut-down (from 15 minutes to about 18 hours). These severe shocks must be avoided if reliability of operation and availability are to be maintained.

The difficulties involved in avoiding these temperature shocks will be appreciated from the graph in Fig. 1. This illustrates the cooling conditions of a set operating on inlet steam conditions of 900 deg F, giving the actual wheel-case temperature of the turbine against times of commencing unloading, together with the required steam temperature should the turbine be recommissioned after a specific period of shut-down. The graph is based upon an unloading time of 30 minutes; a different unloading time would slightly affect the two curves.

Several means of eliminating temperature shocks due to this cause have been tried (for example, high level burners and dump condensers), but these methods have been only partially successful and have involved considerable wastage of water and heat. The control operations with these methods have been delicate and of relatively long duration.

In this system of superheat boost hot gases from gas turbine type oil burners, attemperated to a suitable temperature, are applied to the superheater to increase the steam temperature to the level required for satisfactorily commissioning the turbine without temperature shock. Fig. 2 illustrates diagrammatically the form of the burner used in the combustors. Combustion takes place in a small external combustion chamber and results in an intense white flame at a gas temperature in the region of 3,000 to 3,200 deg F. Combustion of the oil is complete in a relatively short distance (12 to 24in, depending on the size of the burner) and the resultant high-temperature gases are attemperated in the diffuser of the combustor by diluting with air or inert gas to reduce the temperature to the required level.

Since combustion is completed in the can of the burner itself, from the burner onwards there is no luminosity in the gases. A small amount of direct radiation from the can burner flame will pass through the outlet but by arranging right-angle bends before the gases are supplied to the superheater, this small amount of direct radiation is eliminated.

Fig. 3 shows a typical application of combustors to a boiler. The number of combustors arranged across the roof of the unit will be such as to ensure uniform gas temperature distribution to the superheater. The size of the combustors and their number can be arranged to suit the requirements of any particular installation.

By this means the advantages of a separately fired superheater are secured without the usual disadvantages associated with this type of equipment, such as direct radiation on the superheater and possible maldistribution of gas and steam. Gas temperature of the non-luminous

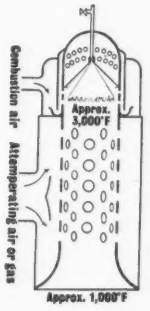


Fig. 2.—Diagram of burner.

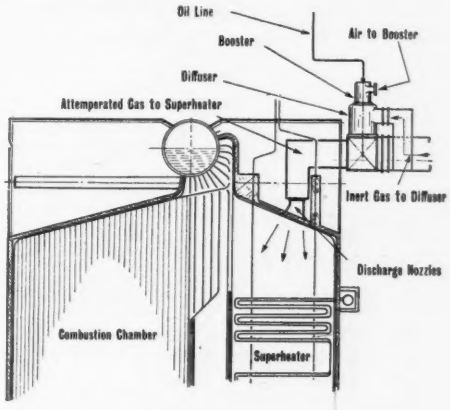


Fig. 3 (right). — Arrangement of burner and superheater

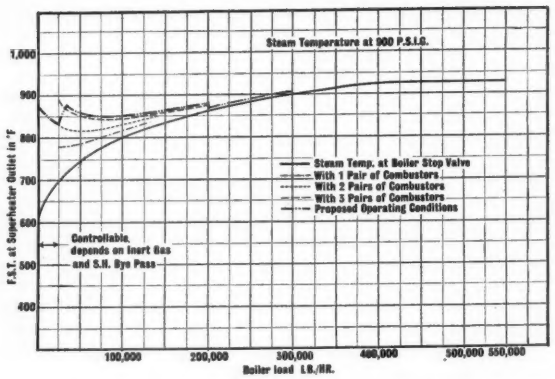


Fig. 4.—Conditions after overnight shut-down (6/7 hours)

gases to the superheater can be controlled at such a temperature that it is not in excess of the permitted metal temperature of the tubes under full-load operation. Steam temperature from the superheater can therefore be the maximum yet complete safety can be ensured.

The steam temperature under these conditions may well be even higher than required at the turbine, but as considerable cooling is to be expected in the associated steam pipes, this represents a further advantage. In reality in most practical cases the control of the combustors will be decided by the temperature at the turbine throttle valve so as to ensure that the pipelines have been adequately heated.

The improvement in the steam temperature which can be obtained by using superheat boost is indicated in the graph Fig. 4. This illustrates the steam temperature characteristic at 900 lb/sq in for a 60 MW unit. The characteristic may, however, be considered as typical for larger or smaller units. It will be seen from this curve that at the loads required for commissioning and running the turbines up to speed, the steam temperature from the unit under ordinary conditions of operation is very little above saturation temperature. To maintain the required conditions with superheat boost, the combustors are operated and switched off in sequence; the effect of this operation is shown in the graph.

The considerable reduction in waste water and heat which can be achieved by the use of the system is also significant. Two comparable graphs, Figs. 5 and 6, illustrate this point. Fig. 5 indicates the normal time and conditions for commissioning a turbine after an overnight shut-down of six hours. These data apply generally whether oil or p.f. firing is employed. The initial 35 minutes are employed in re-establishing boiler pressure lost during the shut-down, when the pressure has fallen from about 900 lb/sq in to about 500 lb/sq in. From then onwards the heat input to the boiler will be that necessary to commission the turbine, heat the pipework, etc. To ensure a satisfactory steam temperature for the turbine, the steam flow needs to be some 140,000 lb/hr, i.e., approximately 25 per cent full load. During the whole of the time of commissioning up to the point when the load carried on the set requires 140,000 lb of steam, the surplus steam must be dumped: a serious waste which at the same time involves careful operating technique.

In Fig. 6 substantially similar data are shown for commissioning the same unit after a six hours' overnight shut-down, but in this case employing superheat boost. The same interval (35 minutes) is required to recover the boiler pressure but by this time, because of the employment of combustors, it is possible immediately to commission the turbine since, while the normal burners may be employed to provide the heat necessary to recover the pressure, the superheat boost burners may be fired at the same time to heat up the superheater and provide the required steam temperature. Using combustors, the steam heat input rate may be maintained as during the pressure rise (equivalent to 35,000 lb/hr), but immediately the turbine is commissioned all the steam may be used for power generation. The only steam which will be wasted during commissioning of the turbine when using combustors is that represented by the difference between a constant heat equivalent of 35,000 lb/hr, and the actual curve showing the turbine requirements, and some of this will be used for warming drains and similar functions.

On this basis, the saving achieved by the use of superheat boost on a typical 60 MW set would be some 4½ tons of coal per start. Assuming 120 starts per year a saving of some £2,000 per year can be envisaged.

Operation of the system is illustrated diagrammatically in Fig. 7. The sequence of operation is briefly as follows: A " stand-by " switch starts up the fuel pump, the combustion air fan, and the attemperating gas fan. The stand-by pilot light is illuminated via three bellows-operated switches arranged to " make " on pressure being established in oil, air and inert gas mains. The mains supply in is also led via these switches. At this stage the magnetic oil fuel valve to the burner is shut tight, the motorized control valve to the burner is in the quarter-load position, the combustion air damper is cracked open

Fig. 5.—Normal commissioning after 6 hours' overnight shut-down

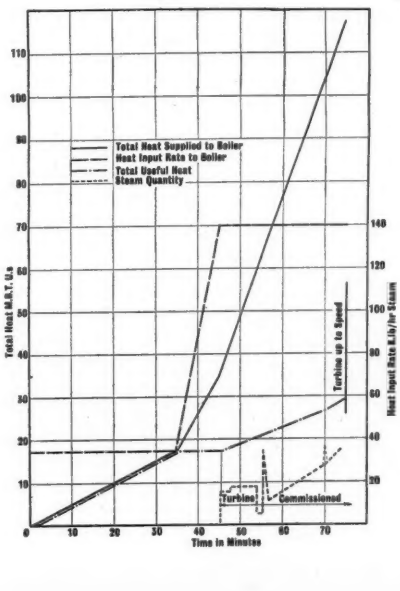
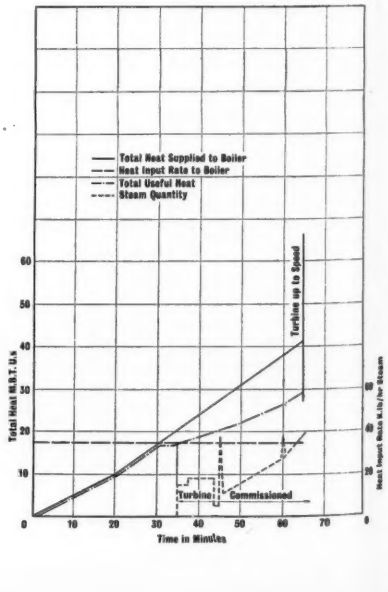


Fig. 6.—Commissioning with combustors after 6 hours' overnight shut-down



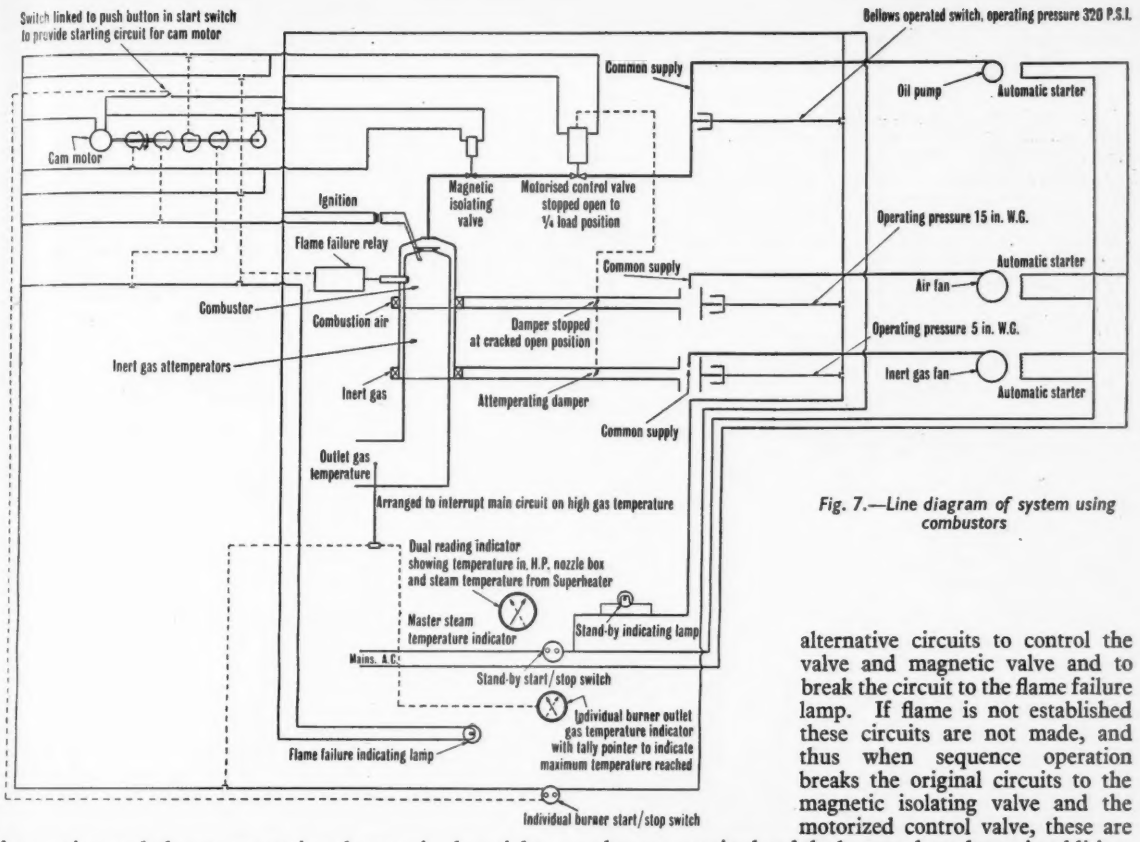

Switch linked to push button in start switch to provide starting circuit for cam motor
Bellows operated switch, operating pressure 320 P.S.I.
Common supply
Oil pump
Automatic starter
Cam motor
Magnetic isolating valve
Motorised control valve stopped open to ¼ load position
Ignition
Operating pressure 15 in. W.G.
Flame failure relay
Common supply
Automatic starter
Air fan
Combustor
Combustion air
Damper stopped at cracked open position
Operating pressure 5 in. W.G.
Inert gas attemperators
Inert gas
Inert gas fan
Automatic starter
Attemperating damper
Common supply
Outlet gas temperature
Arranged to interrupt main circuit on high gas temperature
Dual reading indicator showing temperature in H.P. nozzle box and steam temperature from Superheater
Master steam temperature indicator
Stand-by indicating lamp
Mains. A.C.
Stand-by start/stop switch
Individual burner outlet gas temperature indicator with tally pointer to indicate maximum temperature reached
Flame failure indicating lamp
Individual burner start/stop switch

Fig. 7.—Line diagram of system using combustors

for purging and the attemperating damper is shut tight. The " start " switch operates in sequence the ignition, the opening of the magnetic oil fuel valve and the attemperating damper; and the full opening of the oil, air, and attemperating gas via motorized control gear.

If flame is established, then a flame failure relay makes alternative circuits to control the valve and magnetic valve and to break the circuit to the flame failure lamp. If flame is not established these circuits are not made, and thus when sequence operation breaks the original circuits to the magnetic isolating valve and the motorized control valve, these are no longer energized and the burner shuts down; in addition, circuit is made to an indicating lamp. The timing for this is two seconds from the opening of the magnetic oil fuel valve. In the case of a high gas temperature the unit shuts down and indication is left on the gas temperature indicator by a " tally " pointer.

Employment in 1954

THE annual report of the Ministry of Labour and National Service (H.M. Stationery Office, 5s) states that in many respects 1954 was a record year. The level of the working population rose in November to 23·9 million, the highest ever recorded in peace time. The main industrial changes were increases in the manufacturing industries, distributive trades and professional, financial and miscellaneous services, and a decrease in the basic industries.

In the manufacturing industries, the biggest increases were 114,000 (4½ per cent) in the engineering group and 53,000 (4½ per cent) in vehicle manufacture. The change in the engineering group was made up of increases of 51,000 (8½ per cent) in the manufacture of electrical goods and equipment, 37,000 (3½ per cent) in general engineering, 24,000 (5 per cent) in metal goods and 5,000 (3½ per cent) in precision instruments, and a decrease of nearly 4,000 (1½ per cent) in shipbuilding and ship repairing.

The estimated labour force engaged in engineering, electrical goods and vehicles (including aircraft) at the end of 1954 was 3,043,000, of whom 620,000 were females, as compared with 2,901,000 (572,000 females) at the end of 1953. The shortage of skilled workers in the principal engineering occupations became more acute during the year. The number of unfilled vacancies for skilled workers increased from 21,758 in December, 1953, to 26,150 in December last year. The number of unfilled vacancies for semi-skilled and unskilled workers also rose. The shortage of draughtsmen continued throughout the year and in December the number of outstanding vacancies stood at 3,204, as compared with 2,654 in December, 1953. At the end of 1954 the labour force of the electrical wiring and contracting industry was 83,000. There was a high level of employment.

Heavy demands were made on the building and contracting industry's manpower for power station contracts, and by the North of Scotland Hydro-Electric Board. At times there were difficulties in finding certain classes of skilled workers for these and other works.

Dealing with the Technical and Scientific Register, the report states that throughout the year the demand for scientists and engineers continued; the number of vacancies notified was 25 per cent greater than in 1953. Mechanical and electrical engineers and physicists were particularly in demand. The Technical Personnel Committee, under the chairmanship of Sir George Gater, continued to keep under review the demand for scientists and engineers, both at home and abroad, and gave special attention during the year to the needs of H.M. Forces and of research and important civilian work.

The report, which covers 162 pages, also deals with such matters as recruitment to industry, training for employment and supervision; resettlement of disabled persons; safety, health and welfare; and industrial relations.

Kingston Productivity Exhibition

"Productivity and production are terms which have come to stay," said Mr. Alexander King, head of Intelligence Division, D.S.I.R., speaking at a luncheon preceding the opening of an "Electrical Aids to Industry" exhibition held at the Kingston Technical College last week.

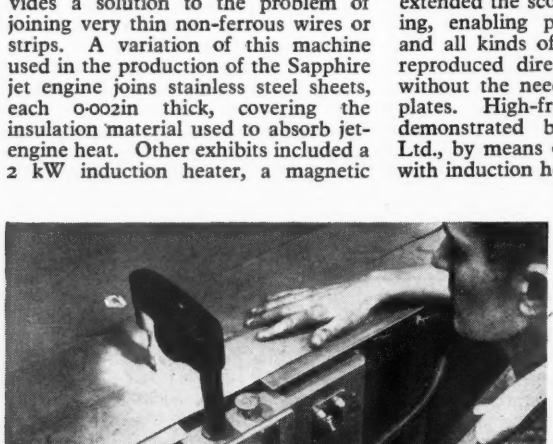
The British Productivity Council, through its local committees, seeks to increase industrial productivity, to which electricity is already making a great contribution. The full scope for the application of some of the more advanced electrical methods, however, particularly in the fields of electronics and high-frequency engineering, is not always fully realized. With these new developments in mind the Kingston and Guildford Productivity Committees in collaboration with the South Eastern Electricity Board's Surrey Sub-Area staged the exhibition, which included a comprehensive display of advanced aids to increased production.

Although not a large display, about twenty firms were represented and several of the items shown are worthy of comment. An infra-red paint repair unit, seen on the stand of the General Electric Co., Ltd., promises a quicker return of cars after paint repair. In addition to the saving in time, the use of infra-red heating also has the advantage of removing the causes of blooming. In the mass production of small components, an electronically controlled spot welder exhibited by the same company provides a solution to the problem of joining very thin non-ferrous wires or strips. A variation of this machine used in the production of the Sapphire jet engine joins stainless steel sheets, each 0·002in thick, covering the insulation material used to absorb jet-engine heat. Other exhibits included a 2 kW induction heater, a magnetic sorting bridge, a layer thickness meter and a range of f.h.p. motors.

The new 6 kW "Radyne" induction heater, claimed to be the fastest and simplest heater of its type to be built, was seen on the Radio Heaters stand. Compact and flexible as the conventional workshop forge, with the added advantage that it may be incorporated in the actual production line, the machine is suitable for soldering, brazing and heat treatment work. There were also examples of "Radyne" plastic welding machines for inspection.

Hanovia, Ltd., specialists in ultra-violet equipment for all purposes, showed their model 5 water sterilizer, a fully automatic unit for sterilizing water up to 2,500 gal/hr without changing taste or chemical composition. For the destruction of airborne bacteria the company's bactericidal unit can be used for either direct or indirect irradiation in food processing plants, hospitals, offices, etc.

A new development in the field of ultrasonic flaw detection displayed by Kelvin & Hughes, Ltd., not only carries out an automatic and rapid examination of a sample under test, but simultaneously presents a permanent paper record. Electro-mechanical and electronic punched card accounting equipment was demonstrated by the British Tabulating Machine Co., Ltd., and Roneo, Ltd., had on view their latest electronic stencil reproduction unit. This development has considerably extended the scope of stencil duplicating, enabling photographs, drawings and all kinds of printing types to be reproduced direct from the originals without the need for films, blocks or plates. High-frequency heating was demonstrated by Philips Electrical, Ltd., by means of a 2½ kW generator with induction heating equipment, and similar equipment, including a selection from a range extending from 100 W to 125 kW, was shown by Redifon, Ltd.



G.E.C. electronically controlled spot welder

Since its formation just over five years ago Decca Radar, Ltd., has successfully developed a range of high quality marine, airfield control and coastal defence radars and also have produced a wide range of "X" and "S" band microwave test instruments. Apparatus displayed included a 10 cm microwave test bench which was presented recently to the Kingston Technical College by the company for use in their labroatories.

The South Eastern Electricity Board displayed some modern examples of electric heating techniques for industrial and commercial buildings, with emphasis on schemes designed to take advantage of the "off-peak" tariff. These included the "Pyrad" and "Panelec" floor-warming systems and the "Nightstor" (G.E.C.) heater.

Courtney, Pope (Electrical), Ltd., provided the lighting fittings used throughout the exhibition.

SYNTHETIC PROTECTIVE RUBBER

A new synthetic rubber, said to be completely resistant to ozone cracking, which dispenses with the need for carbon black reinforcement has been perfected by the American Du Pont organization. It is called "Hypalon" and is distributed in this country by Durham Raw Materials, Ltd. It is claimed to be of particular value as a protective coating for a wide range of rubber goods and fabrics. It shows good adhesion qualities with rubber, fabrics, paper, wood, concrete and metal and is flexible at low temperatures, being effective at −65 deg F without the aid of plasticizers. Resistance to sunlight, scuffing and abrasion is exceptional and it can be compounded in cement form in a wide variety of colours without any difficulty. In addition, "Hypalon" resists the deleterious effects of chemical action, particularly the oxidizing inorganic acid group, and is heat-resistant up to 250 deg F. It is therefore suitable for use by manufacturers of insulated wire and cable, particularly as "Hypalon" lacquers can be applied as a thin coating to other rubbers by brush or spray.

In extensive flex-tests it was found that the "Hypalon" coating stretched 100 per cent and that after 300,000 actions in a flex-tester it showed no signs of film failure or loss of adhesion. In all cases, the rubber stock underneath had cracked and broken. Weather tests were also withstood. The material can be compounded on a mill or in a Banbury mixer like other rubbers and is easily reduced to a solution.

SCANDINAVIAN POWER SCHEME

Plans are being worked out for the construction of a Swedish-Norwegian hydro-electric power station between the Norwegian Lake Limingen and the Swedish Lake Kvarnbergsvattnet. Each country will receive about half of the power produced. For Sweden this would mean about 150 million kWh per annum, which is slightly more than 0·5 per cent of Sweden's yearly power production.

The Coal Debate

Plans for Increased Use of Oil

COAL exports are to be sharply reduced and industry is to make a bigger use of oil in place of coal, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, told the House of Commons during the debate on the coal industry last week. He said that by 1960 it was hoped that industry would be using oil equivalent to 25 million tons of coal a year—250 million tons over the ten-year period in which it was planned that atomic energy would begin to provide an alternative source of power. One of the first two atomic power stations —to serve London—would probably be on an Essex river, near the sea, and the other would be on the Severn, serving the Birmingham and Bristol areas, he said.

The Minister told the House that the new National Industrial Fuel Efficiency Service was most successful in its first year. First-aid services had been given to 5,500 firms, one in six of the industrial consumers of more than 100 tons a year. It was estimated that as a result of this work a million tons of coal would be saved this year. The Government had decided to improve the fuel efficiency loan scheme and would abolish the limit on the cost of each individual scheme. That would help considerably the conversions from coal to oil and also to the large back-pressure turbine schemes.

It was not possible to reduce coal exports by more than two million tons this year, but in 1956 the Government had reluctantly concluded that there must be a sharp reduction, resulting in a corresponding fall in our need for imported coal. The increase in deep-mined coal last year was about 500,000 tons and it was estimated that the increase in industrial consumption resulting from rising activity was about 3,000,000 tons. It was obvious that the coal industry alone could not produce the fuel required and it needed help. For the first time in this country oil had become competitive with coal for steam-raising on a large scale. A second contract with another oil company had been signed that day for the use by the Central Electricity Authority of a further 3 million tons of oil; this meant that by 1960 the C.E.A. would be using oil to the equivalent of about 9 million tons of coal a year. The gas industry would use new processes to make towns' gas entirely from oil—in one case taking oil and petroleum gases direct from a refinery—so that more than a million tons of coal would be saved.

There had also been a sharp rise in the use of oil for heating and steam-raising in general industry; in fact, the increase in April was 51 per cent above the year before. Of the new boilers ordered by industry this year, 90 per cent were either for dual-firing or for oil, and only 10 per cent were for coal only. All this took place before the last price increase for coal, which was the equivalent of a reduction of £1 a ton in the price of oil. This was bound to have a powerful effect. The oil companies had assured him that they could supply, in addition to the normal increase of 3 million tons, a further 6 million tons in the next five years. There were still further possibilities, because low-flash oil and even crude oil were being successfully used, and the supply of these was unlimited.

Nuclear Power Programme

As from 1960, the atomic energy programme would begin to make its contribution. For maximum economy, the first atomic power stations would be far from the coalfields and near to the great centres of consumption. The Minister then referred to the atomic stations for London and the Birmingham area. The programme, he said, was not limited by finance but by the number of scientists, engineers and designers with the necessary skill in this special sphere. Numbering hundreds rather than thousands, they must not be overloaded or the House would have the story of the coal industry over again. But if the work proceeded faster than now seemed likely, the Government would certainly expand the programme.

These fuel allies were marching to the rescue of the country and the coal industry, removing the spectre of the "coal gap" and giving the coal industry some relief to get on with its own tremendous reconstruction plans. This industry must make fresh efforts to economize in men by still more mechanization. Coal cutting was at present 85 per cent mechanized, but there was a big gap in the production chain after that because only about 9 per cent of the coal was power-loaded, the rest being loaded by hand. There were still 80,000 workers shovelling coal in the old-fashioned way. He was glad to say that the Coal Board was launching a full-scale power-loading drive and hoped by this means to save 25,000 men in five years. More ought to be done, however; the Board had got to make tremendous efforts to develop improved machines and mining techniques.

There lay before the country a fuel battle for some years to come which would be hard to win, but the Government's fuel policy gave grounds for confidence, he concluded.

Opposition Criticisms

Mr. Philip Noel-Baker, speaking from the Opposition Front Bench, said the Government had taken no adequate action to help the Coal Board to arrest the fall in manpower or to get more men. Apart from the new wages structure, they could help with housing, supplementary pensions, and perhaps a bonus for men who transferred to a coalfield where they were wanted. Next, they had to stop the waste of coal. No country wasted it as we did, yet great economies had been made by the nationalized industries. The C.E.A. in 1954 saved 4½ million tons by the increase in the thermal efficiency of its stations. The Gas Boards saved 2 million tons, the Coal Board 2 million tons, and the railways 1 million tons compared with 1950. Where would the Minister have been, but for these savings?

In general industry, the picture was very different: nineteenth century boilers, wasteful stoking, and inadequate insulation, lagging, supervision and control. To set up N.I.F.E.S. the Government wiped out the Ministry's own fuel efficiency service, against the advice of the Ridley Committee. If it had been retained, it could have expanded its service far beyond what N.I.F.E.S. had reached to-day. There were still thousands of untrained stokers firing Lancashire boilers, each of them wasting every week as much coal as a miner in the pit could dig. After three years, the Minister had approved 139 loans to industrial firms for installing new fuel-saving plant; 100 of them in the last twelve months. Yet there were 32,000 firms using more than 100 tons of coal a year, most of them needing new equipment. At this rate the Government would get around the job in about 300 years from now. The Beaver Committee had told Parliament that air pollution cost the nation £300 million a year, and £50 million—almost as much as the Minister was spending on coal imports—represented fuel that was wastefully burnt and went up uselessly in smoke. Yet when he asked the Government to give the Smoke Abatement Society a subsidy of £3,000 to expand its excellent work they turned it down.

Mr. F. W. Farey-Jones said that unquestionably the gas and electricity industries must be given greater freedom and the monopoly of the Coal Board diminished. Mr. Aubrey Jones considered that the only long-term remedy was more investment. The fortunes of the Coal Board were far gone. The only chance of retrieving them was by establishing an efficient and properly constituted Coal Board.

Sir Albert Braithwaite said that the Government need

not have imported a single ton of coal had opencast coal been fully exploited. There were plans for the extraction of 50-60 million tons of opencast coal but the land was not released. The country had lost £300 million by not going ahead with this scheme in a proper way.

Mr. Gerald Nabarro said that in the first six months of this year coal production had fallen by 2,500,000 tons. Next year he believed we should have to import 25 million tons and the adverse effect of this would be £170 million in our balance of payments. The Minister's policy was to substitute oil fuel, but this would aggravate the balance of payments position to only a slightly lesser extent. Sir Frederick Simon, Professor of Thermodynamics at Oxford, had said that the total fuel economy of which this nation was capable within a ten-year plan was sixty million tons a year. Mr. Nabarro said he believed that a ton of coal saved by greater efficiency, supported by the appropriate capital finance, was infinitely more valuable than a ton of coal mined. To achieve efficiency new legislation was urgently needed requiring the certification to minimum standards of proficiency of all industrial boilermen and firemen within a period of two to three years. All new boiler plant should conform to minimum standards of efficiency and every new industrial building should be properly insulated. Fourthly, the Government's "anti-smog" Bill was urgently needed and he hoped it would be law before Christmas. Finally, industrialists should be allowed to charge certain specified industrial fuel economizing equipment against profits for tax purposes in the year in which they were installed—in other words, a 100 per cent initial allowance.

Mr. George Darling said the country must have a fuel policy which worked to the point—which he hoped was not far distant—when it would be laid down by law that no raw coal should be burned. It was possible now to provide carbonizing plant to produce gas, coke, tar and all the chemical by-products derived from tar from all coal, except the small coal which could be used in the power stations. Gas could be used in far greater quantities for industrial purposes. We ought to have gas turbines running our power stations, because these were the most efficient motive power units yet put into operation. This policy should be brought into operation over the next ten to twenty years.

When Mr. Darling agreed with Mr. Nabarro's scheme for 100 per cent initial allowances, Mr. Robson Brown asked whether he put any limit on tax relief for modern steam-raising equipment. Some large organizations had a £250,000 power station. Would that be included because it saved fuel? Mr. Darling said he would have no limit.

Government Reply

Replying to the debate on behalf of the Government, Capt. Harry Crookshank, the Lord Privy Seal, rejected the criticism of the N.I.F.E.S. which, he said, was set up on the advice of the Pilkington Committee, which consisted of industrialists and people directly concerned, and there was no gap between the Ministry's service ending and the new one beginning. Expenditure by industry on fuel-saving equipment was going up all the time; it was £8,500,000 in 1950 and £12,500,000 in 1954. In May, 1954, the first month in which the new service operated, eight surveys were made; last month it was making 64 surveys. One in six of the industrial consumers who used more than 100 tons a year received advice in the first year. That was a creditable record. Mr. Nabarro's initial depreciation allowance of 100 per cent on fuel-saving equipment would be difficult to apply. There were so many different methods of fuel economy that it would be very hard to put on a discriminatory tax, as Mr. Nabarro himself admitted in 1953. If he would find it hard, it would be quite impossible for the Inland Revenue to make any discrimination.

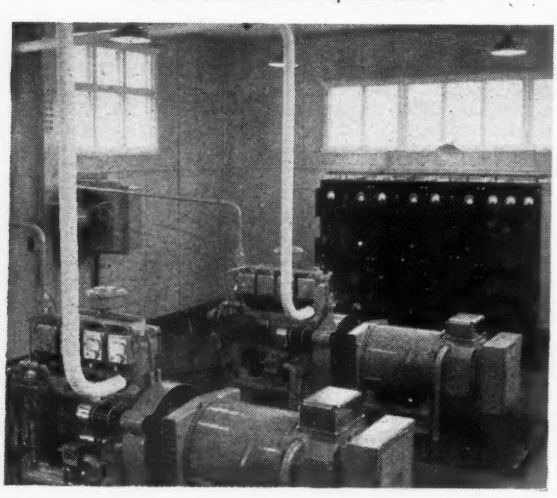
In the rest of his speech, the Lord Privy Seal did not refer to the other points of Mr. Nabarro's speech or to the promised legislation to reduce air pollution.

MOUNTAIN TOP V.H.F. STATION

AN unusual installation of three 15 kW Russell Newbery diesel generating sets is among the chain of repeater stations established by the Australian Department of Civil Aviation several months ago, and one is at Mount Barrow, Tasmania—a site well over 4,000ft above sea level, usually snow-bound for the greater part of the winter and consequently almost inaccessible for a part of the year.

As v.h.f. communication depends on "line-of-sight" transmissions, it will be appreciated that most of the stations are established on mountain tops to provide for maximum distance coverage. The Mount Barrow site relays messages between Tasmania and the mainland on all civil aviation matters.

Inside the Mount Barrow repeater station



In planning the installation the Department of Civil Aviation had to choose between the extension of a feeder line from the Hydro-Electric Commission's network, with an automatic generating set on site for emergency supply conditions, or a multiple engine installation with automatic facilities from one to the other. The extension of the feeder line proved to be uneconomical as first costs were excessive. It became necessary, therefore, to establish a fully automatic power station on the mountain, and the three Russell Newbery sets were chosen.

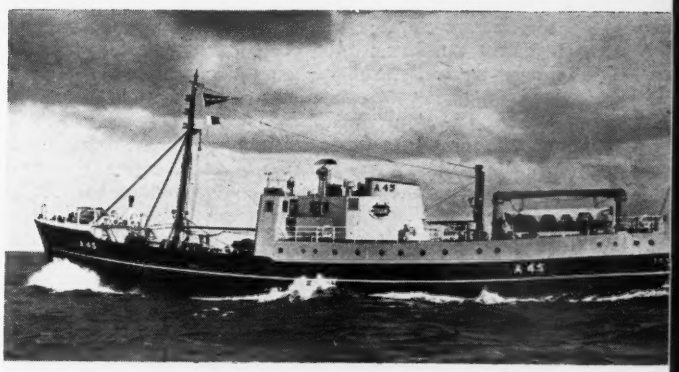
Because inaccessibility of the site in winter precluded regular maintenance and re-fuelling visits, the station was planned for operation for fully unattended periods of up to six weeks' duration. The mode of operation is to start any one of the three units as a primary source of power, and switch the remaining two to a first and second stand-by duty. Should the primary set fail owing to low lubricating oil pressure, high water temperature or any other cause, automatic change-over is effected with an interruption in the generation of only six seconds.

Factory Equipment Exhibition

The fourth Factory Equipment Exhibition will be held at Earls Court, London, from 9th to 14th April, 1956. The whole of the ground floor at Earls Court has been reserved. Further details regarding space, etc., can be obtained from the Organizer, Factory Equipment Exhibition, 4, Snow Hill, Holborn Viaduct, E.C.1.

Diesel-Electric Trawler

FISHERIES RESEARCH VESSEL "SIR WILLIAM HARDY"

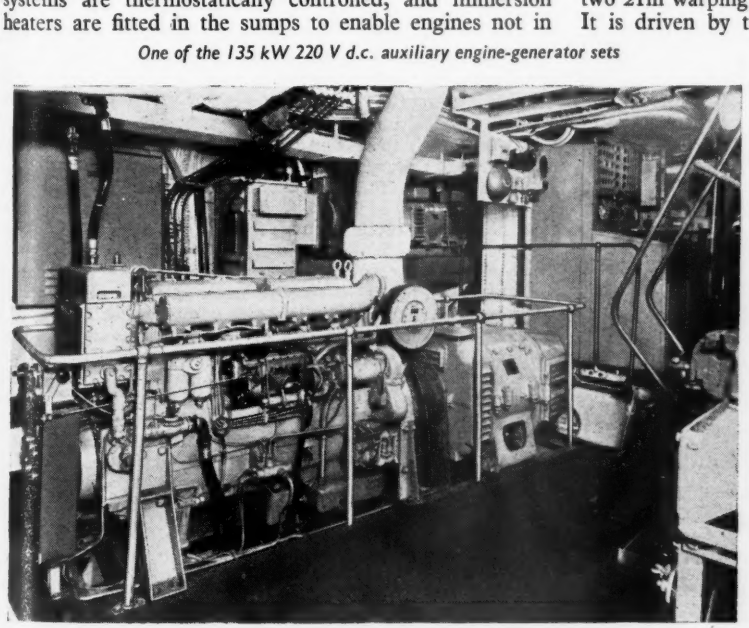


[Photo by courtesy of Hall, Russell & Co.

ACTING on behalf of the Department of Scientific and Industrial Research, the Admiralty placed an order for the first British diesel-electric trawler—a fisheries research vessel. Built by Hall, Russell & Co., Ltd., this vessel was launched on 29th November, 1954, and named *Sir William Hardy*. The trawler, whose trials have recently been successfully completed, is designed for carrying out research work on the preservation of fish as food and is provided with a well equipped laboratory and accommodation for four scientists, in addition to the normal crew of sixteen. The fish rooms are specially insulated; one of them is fitted with a quick freezing plant of special design. Considerable use has been made of aluminium in the construction of the forward fish room. The principal dimensions of the vessel are length 131ft, breadth 27·5ft, and depth 15ft.

The diesel-electric propulsion equipment was supplied by the Metropolitan-Vickers Electrical Co., Ltd. The four main six-cylinder diesel engines, manufactured by Henry Meadows, each with a 24-hour rating of 200 b.h.p. at 1,400 r.p.m., are directly coupled to 125 kW constant current generators through flexible couplings. Each diesel-generator set is mounted on a combined bedplate secured to the seating by "Silentbloc" flexible mountings and is fitted with fresh and salt water circulating pumps, heat exchangers and oil coolers. The fresh-water circulating systems are thermostatically controlled, and immersion heaters are fitted in the sumps to enable engines not in service to be kept warm. Each engine has its own instrument panel, with an exhaust pyrometer, pressure gauge and tachometer. The C.A.V. fuel pumps incorporate a special governor which can be set to operate at the normal speed of 1,400 r.p.m. or for special duty at 1,000 r.p.m. The generators are provided with top-mounted combined isolating-and-transfer switch cubicles, so that each unit can be used independently.

One of the 135 kW 220 V d.c. auxiliary engine-generator sets



The propulsion motor is a 600 s.h.p. 200 r.p.m. double unit machine. It is equipped with a disc lubricated sleeve bearing at the forward end, and a combined thrust and journal bearing of the Michell type at the aft end. The motor is ventilated by duplicate centrifugal fans which take their air supply from above deck and exhaust it into the engine room. The motor is watertight up to the shaft level. Speed limiting and tachometer generators are belt-driven from the forward end of the motor. There is also a mechanical overspeed emergency switch. Excitation is provided by exciter sets each of which consists of a 17 h.p. 1,500 r.p.m. motor driving two metadyne exciters. One exciter controls the speed and output of the propulsion motor, and the other the constant current system of propulsion. Duplicate exciter sets are provided, one acting as a stand-by.

The trawl winch, which was made by C. D. Holmes & Co., Ltd., is of standard design having two barrels, each with a capacity of 650 fathoms of 2·75in trawl warp, and two 21in warping drums fitted with automatic lubrication. It is driven by two identical 75 h.p. motors which are mounted below deck. Each motor is a horizontal spindle marine type machine driving through a Crofts bevel gearbox and an inclined shaft which extends through the deck to a second drive on the lay shaft of the winch. Under normal conditions both motors operate the winch, but clutches enable either machine to be disconnected in emergency. The motors are of the constant current type fitted with governor exciters and forced ventilation and are suitable for a stalling torque of 1·5 times full load, which they will withstand for 30 minutes without overheating. The normal full-load speed is about 1,000 r.p.m., and the light-load speed is about 1,750 r.p.m.

The propulsion and trawling circuits operate on the constant current system. All four generators, together with the propulsion motor and trawl winch motors, when in

service, are connected in a series loop through which a constant current of 500 A is circulated. A generator metadyne exciter supplies all generator fields in parallel, and it regulates the excitation so as to maintain the current at a fixed level, varying the output voltage of the generators to suit the power demand. On full load the maximum voltage of the system is 1,080 V, and the arrangement of the connections ensures that the voltage above earth never exceeds 540 V. Any generator can be cut in and out of the circuit by means of its transfer switch which is interlocked with the respective field switch.

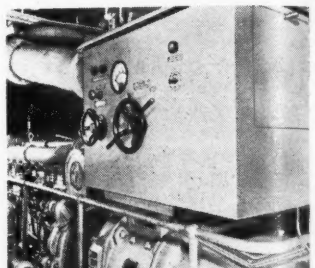
As the propulsion motor armatures are supplied with constant current, the torque can be controlled in magnitude and direction solely by controlling the motor excitation. To reduce the control currents to a small value a metadyne exciter is used to supply the fields, and the bridge or engine room controller operates directly on the field of this exciter. The use of a metadyne exciter also enables overspeed control of the propulsion motors to be obtained very easily and permits automatic reduction of power when any engine is cut out of service.

The winch motors are controlled in a somewhat similar way to the propulsion motor, except that the field current is supplied directly through a reversing potentiometer, and speed limitation is obtained by a direct-coupled governor exciter in opposition to this field supply.

Under normal conditions the vessel is controlled from the bridge, which is provided with a combined controller and bridge telegraph comprising a special Robinson twin-screw pedestal fitted adjacent to the starboard bridge wing.

When on engine room control the propulsion motor is operated by a handwheel mounted on the front of the control desk, and this is mechanically coupled to a controller similar to that used for bridge control. The control desk also houses the bridge/engine room change-over switch, metadyne change-over switch, telegraph indicators, revolution counters, voltmeters, ammeters, and various visual and sound alarms.

One of the four 125 kW main generators and its switching cubicle



An auxiliary supply at 220 V is provided by two diesel-generator sets consisting of Meadows engines identical with those for main propulsion and 135 kW level-compound generators. A Hamworthy electrically driven two-stage compressor provides starting air for the main and auxiliary engines; it is capable of supplying 9 cu ft of free air per minute at 450 lb/sq in. For emergency purposes there is a smaller diesel-driven compressor suitable for a delivery of 6 cu ft/min to the same line pressure. Four air receivers each of 5 cu ft/min capacity are provided, one being fitted with a reducing valve to supply air at 100 lb/sq in to operate a whistle and for use in the laboratory.

Large Telephone Installation

AN independent automatic exchange system has been adopted by Rolls-Royce, Ltd., to serve the head office of its organization at Derby, and, on 21st July, one of the largest private networks ever to be installed in an industrial concern in this country began full operation. Equivalent in size to that required to provide a telephone service for a small town with a number of surrounding rural communities, the new exchange network will link Rolls-Royce's head office and main works in Derby, with the company's other factories and workshops throughout the area.

The new network, designed by engineers of Communication Systems, Ltd., the sales and maintenance organization of the Automatic Telephone & Electric Co., Ltd., who manufactured the equipment, will provide an efficient day and night service, the "nerve centre" of the new system being a 1,000-line exchange at the main works, which is linked by a series of tie-lines to smaller automatic exchanges serving other offices and works throughout the Derby area. To meet future needs provision has been made to double the capacity of the main exchange, when this becomes necessary.

Checking a section of the new Rolls-Royce automatic exchange

A feature of the system is the provision of "cut-in" or priority facilities which enable persons using selected extensions to break-in on a line, after they have dialled the number and received the engaged tone, in order to contact anyone required urgently. This service has been provided mainly for the use of the company's fire service posts and first-aid centres, and is unique in so far as it can be used over tie-lines to find a person required in any part of the network.

The largest satellite exchange in the network (250 lines) is situated in the company's research and development establishment, about 1½ miles from head office, and is linked to the main exchange by twenty tie-lines. The nearby oil engine division, where Rolls-Royce diesel engines are produced, is served by a 150-line exchange and nine tie-lines link it with the head office and aero engine works.

The aero division technical offices are served by a 200-line automatic exchange. Situated in premises about half-a-mile from head office, this exchange is linked with the main exchange by eighteen tie-lines. A 200-line automatic exchange has also been installed at the company's foundry. The longest link in the network is between head office and a 50-line automatic exchange in the printing and publications department 3½ miles away on the other side of Derby.

Special facilities which have been provided to work in conjunction with the new telephone network include a "secretarial service."

A new loudspeaking telephone designed to occupy no more than normal telephone desk space, while at the same time providing high-quality performance, is also being used.

Irish Board's Increased Profit

Abnormal Rainfall Assists Hydro-Electric Output

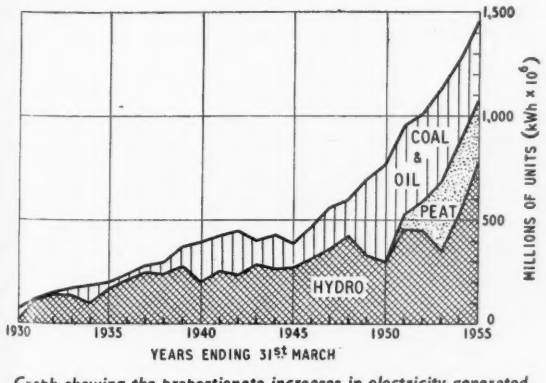
EXCEPTIONALLY heavy rainfall had a beneficent effect on the finances of the Irish Electricity Supply Board during the year ended 31st March last. Because of it the Board's hydro-electric stations were able to generate more than half of the total production (53·4 per cent), the two peat stations at Portarlington and Allenwood accounting for 20 per cent and coal and oil stations for the remaining 26·6 per cent. The hydro-electric output of 779 million kWh compared with 590 million kWh in the previous year. Altogether, 1,458 million kWh was generated against 1,292 million in 1953-54, an increase of 12·8 per cent.

The record production from water power resulted in a saving of some £500,000 on fuel in comparison with a year of average water conditions. Largely in consequence of this, the Board's working expenditure fell by £273,748 to £4,915,852, while at the same time gross revenue from the sale of electricity rose by over £1 million to £9,565,256. Although the working surplus of £4,649,404 (£3,265,820) had to bear substantially higher charges for plant renewal, interest, etc., there was a net balance of £885,409 (against £233,209). With the addition of profits on merchandise and installation trading, the surplus was raised to £928,659.

A sum of £300,000 has been transferred to the contingencies reserve, which is thus brought up to £1 million; £500,000 has been placed to a fuel equalization reserve, the income tax reserve has been increased by £100,000, and payments totalling £43,639 in commutation of Pigeon House "walking time" rights have been written off. The allocation to the fuel equalization reserve, the Board's annual report explains, is a logical consequence of the favourable hydro conditions of the year, and is regarded as a necessary provision against dry years.

Withdrawal of Rural Subsidy

Capital for development has been provided mainly by Government advances, of which £2,444,635 has been repaid, leaving an outstanding balance of £50,403,001 at the end of the year. The Electricity (Supply) (Amendment) Act, 1954, authorizes direct borrowing by the Board and it is stated that an issue to provide capital for future development will be made to the public in the autumn.



Graph showing the proportionate increases in electricity generated by water power, peat, and coal and oil

Under the rural electrification scheme the total investment of capital was £12,854,024. Recently the Board has been informed that the 50 per cent subsidy would not continue and that legislation would be introduced to this end. It has also been intimated that the removal of the subsidy would be retrospective in effect, so that a sum of approximately £4,800,000 which appears as a non-repayable receipt in the present accounts will become a liability on the passing of the legislation.

New Generating Stations

The totalled installed capacity of the Board's generating plant at the end of March last amounted to 452·5 MW, comprising 264·5 MW of steam plant and 188 MW of hydro-electric plant. New stations which will increase the generating capacity by 376 MW are under construction or planned as follows:—

Station	MW	Probable Commissioning Year
Ringsend (coal or oil fired)	90	1955-56
Ferbane (peat fired)	60	1956-57
Four hand-won-peat fired stations	20	1956-57
Lee (hydro)	27	1957
Arigna (coal fired)	15	1957
Clady (hydro)	4	1957
Lanesboro (peat fired)	20	1957-58
Rhode (Derrygreenagh) (peat fired) ...	40	1958
Bellacorick (Oweninny) (peat fired)	40	1959
Blackwater (peat fired)...	40	1959
Bangor Erris (peat fired)	20	1960
Total ...	376	

The number of consumers at the end of 1954-55 was 461,901, representing an addition of 25,916. They were supplied at an average price of 1·92d per kWh sold, which compares with 1·94d in the previous year and 1·97d in 1952-53. Domestic consumption rose by 12 per cent to 479·4 million kWh and motive power by nearly 15 per cent to 401·4 million kWh. A considerable expansion in supplies for night storage heating is noted, these increasing by nearly 22 per cent to 75·4 million kWh.

Sales of appliances totalled £662,542 (£460,837 in 1953-54) and the credit taken for consumers' installation contracts completed amounted to £429,302 (£321,030).

During the year 125 miles of 110 kV lines, 70 miles of 38 kV lines and 86 miles of 10 kV lines (excluding rural lines) were erected. Constructional work was started on new 110 kV transformer stations at Portlaoighise and Carrickmines and satisfactory progress was maintained on the stations at Wexford, Kilkenny and Cahir. Fourteen new 38 kV stations were completed and put into operation.

Under the rural electrification scheme 364 areas have been completed to date. During the year 4,977 miles of rural transmission lines were erected and 29,812 new consumers were connected, bringing the total at 31st March to 128,634. A further acceleration in the rate of development took place: 75 areas were completed, compared with 60 in the preceding year and at the close of the year construction was proceeding at the rate of 100 areas per annum. With the increase in the rate of construction it is expected that all the 780 areas under the original plan will be supplied within five years. The 364 areas completed cover 9,587 square miles. Supply is now

available to about 45 per cent of the rural population and the proportion of dwellings connected in the completed areas is approximately 72 per cent.

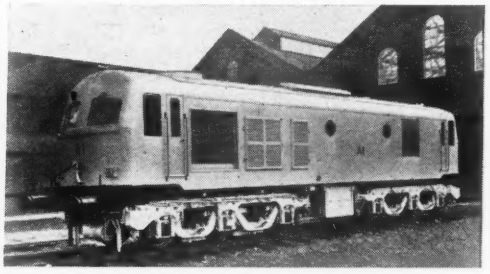
The extent to which consumption is increasing in the areas connected in the early years of rural development is shown by the rise in the average annual consumption per consumer from 509 kWh in 1949 to 1,334 kWh last year.

Capital expenditure during the year amounted to £3,132,153 and the total invested in the scheme to 31st March last was £12,854,024. Sales of electricity, at 165·7 million kWh, were 30 per cent more than in the preceding year. Revenue earned was £1,817,914, or 2·64d/kWh.

Locomotives for Ireland

Progress with Large Metropolitan-Vickers Contract

JUST over a year ago Metropolitan-Vickers Electrical Co., Ltd., secured a contract worth £4¾ million for the supply of 94 diesel-electric locomotives to Coras Iompair Eireann (Ireland's transport company). The first of these locomotives is completed and is now running on the railways in Ireland. The others are being made at the rate of eight every month.



The first M.-V. locomotive for Coras Iompair Eireann

This contract was unique in two respects. First, it was the principal feature in a change-over from steam to diesel traction, and the C.I.E. was the first national body to undertake such a complete transition. Secondly, it was the biggest contract ever placed in this country for diesel locomotives and was secured in the face of severe American and Continental competition. It covered 60 1,200 h.p. Co-Co locomotives and 34 550 h.p. locomotives of the Bo-Bo type. Work is proceeding on both sizes, but only the larger are approaching completion since they are to be delivered first.

The chief reasons for changing from steam to diesel traction on the C.I.E. railways are economic. The average operating efficiency of a diesel locomotive is from six to ten times as great as that of a steam locomotive, and although coal costs less per ton than diesel oil fuel the balance of cost is in favour of the diesel. Considerable economies are obtained from the ability of the diesel locomotive to do much more work than its steam counterpart, so that fewer diesel locomotives than steam are required to work the traffic of the railways. Further savings result from the lower maintenance costs and smaller expenditure on driving staff.

As in all diesel-electric locomotives there are three main components. They are the engine (made by Crossley Bros. of Manchester), the electrical equipment (made by Metropolitan-Vickers at their Manchester and Sheffield factories), and the mechanical parts (made by Metropolitan-Cammell Carriage & Wagon Co. of Birmingham).

A steel body consisting of walls and roof mounted on a rigid underframe carries most of the power equipment and has at each end a completely enclosed driving cab. It is carried on two three-axle bogies connected to the body through pivots. Incidentally the track gauge is 5ft 3in, 6½in wider than in Great Britain. Each of the six axles is driven by an electric traction motor, the power for which is supplied from the d.c. generator (continuous rating 1,208 A, 620 V) driven by the diesel engine. The engine and generator are bolted directly together and mounted in the middle of the body.

When the locomotive is working the driver sits in the leading driving cab in front of the controls, which are duplicated so that he can drive from either the left or the right side. The chief controls are a master controller for regulating the direction of motion of the locomotive and the power from the diesel engine, and the brake levers for controlling the vacuum brakes on the locomotive and train. In addition there are a few instruments and gauges, which keep the driver informed of the working of the various pieces of apparatus.

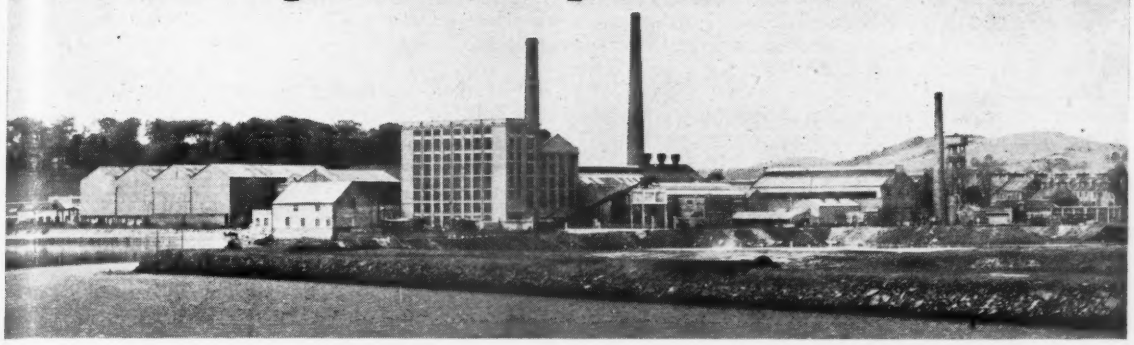
The diesel engine is of the two-stroke type that Crossley Bros. have been manufacturing for many years. It has eight cylinders arranged in "V" formation and develops a maximum power of 1,200 h.p. at 625 r.p.m. This provides 60 h.p. for the auxiliaries and 1,140 h.p. for traction, which is sufficient to haul both goods and passenger traffic up the maximum gradients of 1 in 40 on the system.

The traction motors drive the axles through 16:65 single reduction gearing. One side of the motor frame rests on bearings carried directly on the axle, while the other side is suspended from the bogie by means of a flexible link. The flow of power from the generator to the motors is regulated by varying the voltage and current in such a way that, whatever the speed of the train, the diesel engine supplies the full power corresponding to the position in which the driver has placed his master controller; this regulation is entirely automatic.

Industrial Automatic Control

AT a joint conference on automatic control in the process industries to be held at Caxton Hall, Westminster, on 4th October by the Institution of Chemical Engineers and the Society of Instrument Technology, Ltd., the following papers will be presented:—"Fundamentals of Automatic Process Control," by R. S. Medlock; "The Dynamics of Process Plant," by J. McMillan; "Automatic Process Control and Chemical Engineering," by B. W. Balls and A. H. Isaac; "Automatic Control Applications in Industry": (i) "Automatic Control in the Steel Industry," by B. O. Smith, (ii) "Automatic Control of Batch Processes," by W. A. Goldstein, (iii) "The Temperature Control of Large Storage Tanks," by W. A. J. Preece, (iv) "Automatic Control in the Pulp and Paper Industry," by N. C. Underwood; "The Economics of Process Control," by S. W. J. Wallis; and "The Development of Modern Control Technique and the Pattern of Future Development," by A. J. Young.

A Progressive Paper Works



INSTALLATIONS OF THE GUARD BRIDGE PAPER CO.

IN our issue of 6th November, 1953, we described the electronic control system on the new paper-making machine of the Guard Bridge Paper Co., Ltd., Fife. We have recently re-visited this paper works and feel that our readers will be interested in the electrical plant of a large paper works and in the experiences of two-and-a-half years' operation of the new machine.

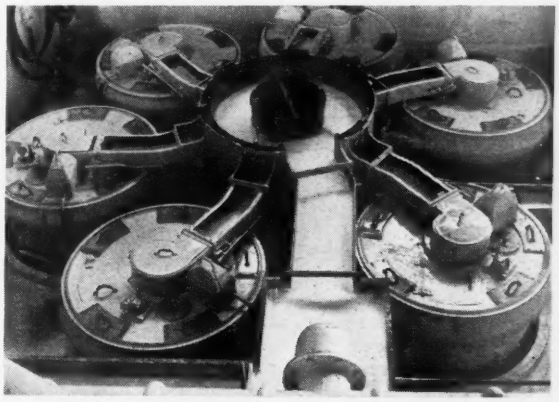
The works is an old one, the company having been formed in 1872 when the first issue of the *Electrical Review* also appeared. It grew up with its surroundings, land was reclaimed and much of the works is built on it; being in the country, a village was built to house the workers and to-day 200 houses are owned by the company who also supply electricity to their part of the village and for street lighting. Six paper-making machines are installed, producing over 800 miles of 87in wide paper weekly.

One of the raw materials of high quality paper is esparto grass imported from North Africa. This grass is taken from store as required and fed into a 45 h.p. conical duster, on the revolving cone-shaped drum of which steel prongs open up, releasing dust which is extracted by fan. Grass is blown by a 50 h.p. fan into boilers where it is cooked with caustic soda. After treatment it is pumped to storage tanks and taken when needed to potchers where bleaching is carried out, through strainers to remove knots and impurities, and through concentrators to remove some of the water. The next stage is that of beating, in which pulp fibres are cut down to the required length. Driving a group of beaters at Guard Bridge is a 500 h.p. 375 r.p.m. Siemens induction motor installed in 1914, and the works has five of these old motors in constant use driving beaters, and a spare. Even to-day the troubles that occur on them are negligible.

Other materials required are then added, such as china clay, rags and starch and the "stuff" as it is termed passes to refiners, and to a group of six purifying centrifuges each driven by a 20 h.p. vertical motor. After passage past a drum strainer the paper-making machine is reached. At this stage the "stuff" is 99 per cent water and much of this is removed by suction under a wire mesh as it passes down the early part of the machine. Further moisture is removed as the paper passes over many steam-heated cylinders to the calenders, also steam heated, for the finishing of the paper surface. The last stages are the cooling rolls, and reels.

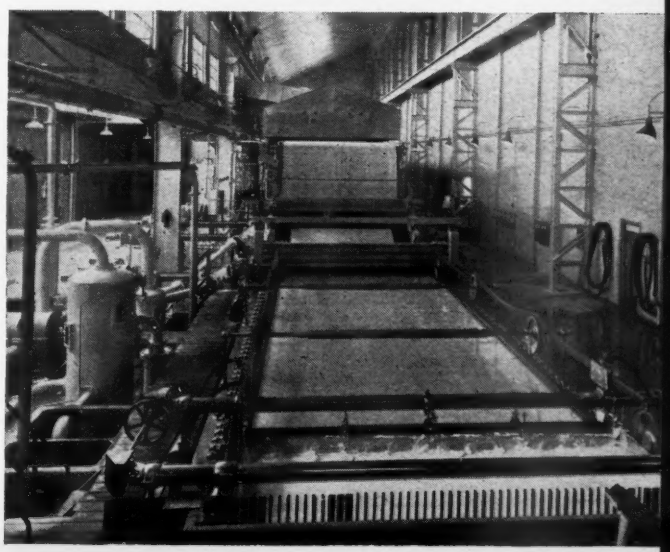
No. 1 paper-making machine is driven by an 80/22 h.p. commutator motor via an endless rope drive along the side of the machine and subsidiary belts to cylinder pulleys on the various stages. No. 2 has a similar motor but an arrangement of line shafting and cone pulleys. Nos. 3, 4 and 5 use 140 h.p. 730/210 commutator motors as a central source of power in each case, Nos. 3 and 4 having line shafting and cone pulley arrangements to provide the speed differentials at individual points, and No. 5 uses a rope drive system with variation through expanding pulleys.

When No. 6 machine was being planned a quotation



From the final purifying centrifuges the "stuff" runs to the paper-making machine

No. 6 machine from the starting end



was obtained for the cost of a mechanical driving system utilizing a d.c. motor with "Ignitron" control, and line shafting to provide the individual drives. The cost of this would have been more than 80 per cent of that of the complete electronic control and individual drive system finally installed. When it is realized that the drive and controls represent less than 10 per cent of the cost of the whole machine, it will be appreciated that the proportionate increase for the highly advanced system employed was very slight. The advantages of the scheme adopted were many: better speed control was obtained of the machine as a whole and of the relative speed between sections, a more even quality of paper results and the maintenance of the equipment is considered much less than that of belts and shafting. On the No. 6 machine there are eighteen separately power driven sections, each d.c. motor being fed from its own generator nearby. A central electronic panel maintains the ratio of motor speeds constant to within 0·1 per cent, individual speeds being capable of adjustment to the desired set value, at local control stations. Altogether about 800 h.p. of motors are associated with it, 455 h.p. of which are on the section drives. As can be seen in one of the illustrations, the driving motors have all been set back some distance from the paper machine, this having been done to limit the temperature rise on the motors which might have been excessive if close to the heated rollers. The mill now employs totally enclosed fan-cooled motors as standard and is adopting a policy of using automatic control gear for motor starting.

With a consumption of electricity of more than 25 million kWh annually and a water requirement of 75,000 gal for every ton of paper produced, extensive provision of their own facilities for both has been found well worth while by the company.

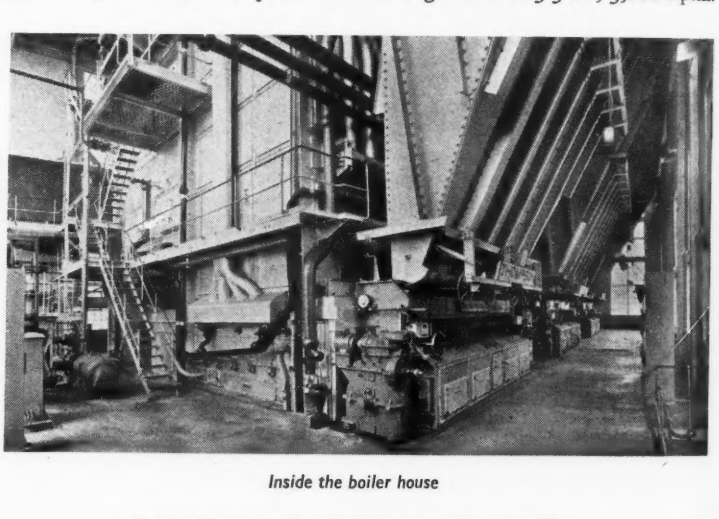
Water is obtained from the Motray Water in the north of Fife, whence a lade and pipes bring it to an 8 million gal capacity 5 acre reservoir near the works. A further lade leads it to a well under the filter house and pumps force it through pressure filters and into roof water tanks in the mill. About 600/700 tons of water is needed hourly and all is chlorinated before passage through the filters. A sprinkler fire protection system is fed by an automatic pump in the filter house, and is also connected to a 7,500 gal water tank on a 70ft high outside tower.

We mentioned earlier that the esparto grass was cooked with caustic soda. This liquor, after the removal of the grass, contains much organic matter and is passed through a triple effect evaporating unit. At the required density the liquor is pumped off to a Wagner furnace where the organic matter is burnt off and the smelt flows into a dissolver tank, while the hot gases pass through a Stirling water tube boiler, generating about 10,000 lb/hr of steam at 200 lb/sq in. The steam pressure is broken down and used throughout the mill along with that from other sources.

The dissolver liquor is pumped to the causticizers and boiled with lime. The sodium carbonate is converted into caustic soda which is re-used in the boiling of the esparto grass and rags. Soda recovery is about 80 per cent.

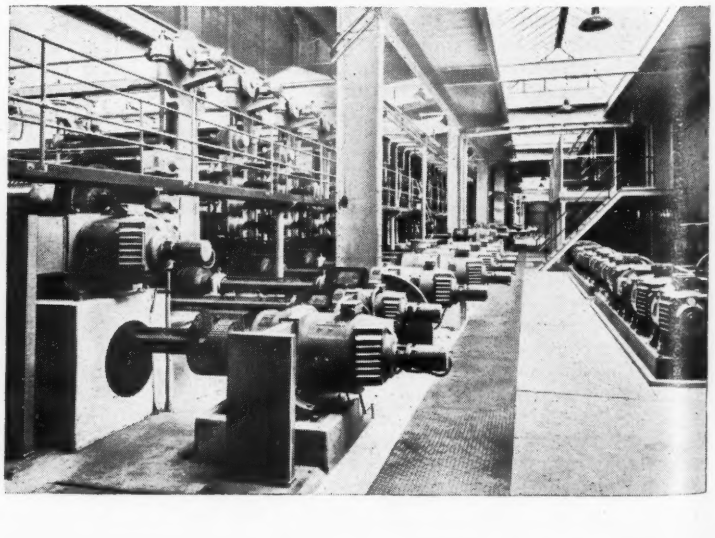
The Guard Bridge paper works has its own excellently kept power station where most of the electricity used in the works is generated. Three John Thompson water tube boilers of 55,000 lb/hr output each are installed, two being sufficient for the load of the mill. Steam is produced at 450 lb/sq in and 775 deg F. About 35,000 tons of "duff" from the nearby Fife coalfields is used annually, just under three tons per ton of paper produced. Coal is delivered into the bunkers by a crane which grabs direct from railway wagons. Each of the three bunkers has a capacity of 225 tons and feeds the boilers direct. Grit arrestors are installed, grit and ash dropping into a water-filled trough for conveyance to ash hoppers above the railway line.

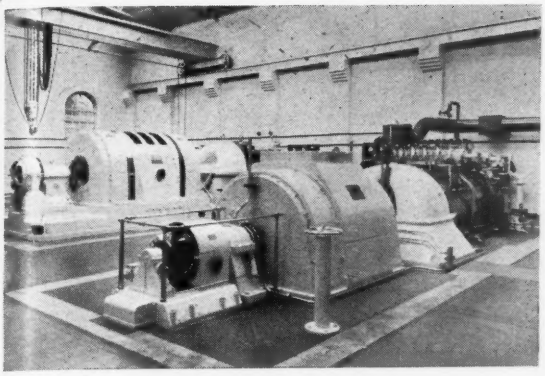
Until five years ago the generating plant consisted of a 3,500 kW Metropolitan-Vickers set, and a 2,500 kW Howden-Siemens set installed in 1914. Six 25,000 lb/hr Babcock & Wilcox boilers also installed in 1914 supplied steam at 200 lb/sq in and 540 deg F. These boilers are now replaced by those described above and the 2,500 kW set has been replaced by a 5,000 kW B.T.H. single cylinder, single extraction machine for 450 lb/sq in and 730 deg F. Both the present machines generate at 3·3 kV, 3,000 r.p.m.



Inside the boiler house

Driving motors on the calender section of No. 6 machine





The 5,000 kW B.T.H. set is in the foreground

Pass-out steam is taken from both M.V. and B.T.H. sets at 32 lb/sq in, up to 70,000 lb/hr being used in this way. Conditions on the sets vary with the paper being produced. A heavy paper requires slow running, a heavy steam demand and less power. A light paper requires less steam and more power.

Supply from both machines is fed to a B.T.H. type QF 3·3 kV switchboard and from there to five 3·3/480 kV 1,200 kVA B.T.H. transformers in the works substation. A B.T.H. electronic voltage regulator can control either alternator. About 400 kW of rectifier plant is installed to cater for a few d.c. motors, some lighting and the village houses belonging to the company. A stand-by Mirrlees-Brush 250 kW 750 r.p.m. diesel alternator set is installed in the power station basement and feeds on to its own 3·3 kV board to which there also comes a feeder from the South of Scotland Electricity Board, via an 11/3·3 kV 500 kVA transformer. This mains supply is used for week-end supplies for essential services and the village, and can be supplemented if necessary by the stand-by set to keep the maximum demand down to any required level. The normal factory load on week-days is up to 3,700 kW and the power factor is kept at about 0·8. No p.f. correction apparatus is installed.

On some of the paper-making machines Baldwin "Atomat" radiation thickness gauges are fitted using the radioactive isotope Thallium 204, the charge of which needs renewing only at four-year intervals. Indication only is given by the gauges installed. These gauges use the principle that beta radiation is stopped by any substance in its path to an extent proportional to the mass of material it traverses. At present materials up to a weight of 1,000 gm/sq metre can be dealt with and the accuracy is of the order of one per cent.

Static Elimination

One problem experienced in the handling of large sheets of paper on machines is that of static electricity, generated as the paper passes over the cylinders and through the calenders. To dissipate the charges, a bar with tinsel tassels hung from it and all connected to earth is suspended across the sheet just before it goes on to the reel. This method is not very satisfactory and recently a new device has been tried. This is the "Corona" static eliminator, manufactured in Sweden, comprising a high frequency generator fed from 250 V a.c. mains which delivers low voltage at 40,000 to 50,000 c/s, and an electrode tube where the low voltage is transformed up to 75 kV. This voltage is non-lethal as the current is only a few micro-amperes.

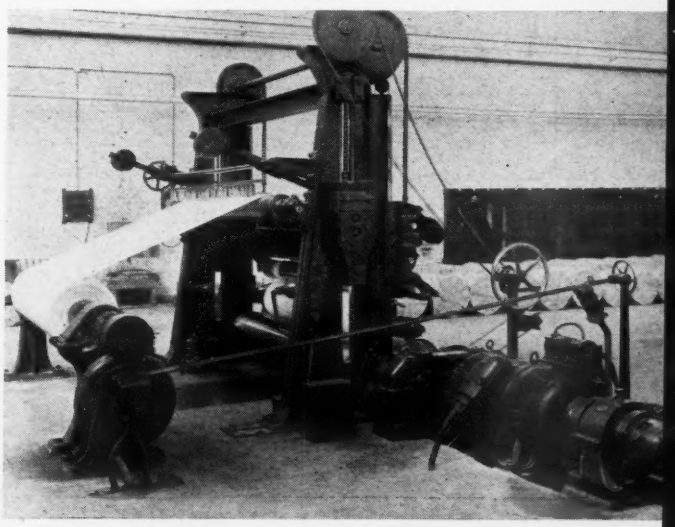
The electrode bar is made to cover the maximum width of paper on the machine and is placed from 15 to 150 mm from the paper. Air ionization is caused by the high-voltage discharge and the air adjacent to the paper and electrode tube is made conductive. As a result an electron is removed from a gas molecule, which itself becomes positively charged and is termed a positive ion. The ejected electron carrying negative electricity unites with another gas molecule which then forms a negative ion, equal numbers of positive and negative ions always being formed. If a substance carrying negative electricity is moved into the ionized air, the positive electrons are attracted while the negative ions are transmitted to the nearest earth conductor. Sufficient positive ions are collected for neutralizing the electric charges and a corresponding number of negative ions are discharged through a conductor, whereby the final result will be the same as if all charges of the paper had been transmitted to earth. This device has been found to be very effective both on paper-making machines and paper cutters.

In view of the considerable quantity of new electronic equipment introduced, we feel some account of the problems involved and how they were tackled will be of interest. It was decided to give intensive training in electronic work to two of the existing electrical maintenance staff rather than engage someone trained electronically and responsible only for the new equipment, the view being held that it was easier to make an electronics engineer out of a good electrical engineer than vice versa. This is a controversial point but it may well be true of maintenance men.

Maintenance work is carried out on Sundays, the trays in the control cubicles being dusted and examined. Valves are not tested as a routine; if one is suspect it is changed, but failures have been rare. The first 100 hours' life is found to be the most critical, after which 10,000-12,000 hours of life may be expected. Out of a total of 64 thyratrons three have been replaced over the 2½ years. Trouble has been commoner on small switches, relays, etc., it being felt that many of these components are a legacy of radio and television practice and should be designed on a much heavier scale for industrial usage.

We are indebted to the Guard Bridge Paper Co., Ltd., Mr. G. P. Adam, M.B.E., general manager and director, and Mr. W. T. Laird, the chief electrical engineer, for their help and for the courtesy extended to us during our visit.

Anti-static tassels in use



OVERSEAS ELECTRICAL TRADE

Exports Seriously Affected by Recent Strikes

LAST month's exports of British electrical equipment were the lowest since April, 1950, reflecting the impact of the dock and rail strikes, particularly the former, which lasted from 23rd May until 3rd July. The full effect, however, cannot yet be assessed for, as the Board of Trade points out, the figures will undoubtedly continue to be distorted for some months to come. For this reason, analysis of the trend of electrical exports is of little value and it is proposed merely to indicate points of interest in the latest figures.

As will be seen from Table I, the total value of exports last month was £9,818,805, a reduction of £3,947,055 compared with June, 1954, and £6,123,580 less than in May of this year. Up to the end of May electrical exports had been running at an average rate of 8 per cent above the value in the first five months of last year, but the June shrinkage brought the aggregate for the half-year almost down to that for January-June, 1954 (see graph).

Table II gives the usual analysis of exports according to destinations. While there has been a general contraction, it is interesting to observe that both the United States and Russia are exceptions. In the case of the U.S.A. the month's purchases of £371,462 compare with £279,324 in June, 1954, and bring the total for the half-year up to

TABLE I.—ELECTRICAL EXPORTS

Class	June, 1955	Six months ended 30th June, 1954	Six months ended 30th June, 1955
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	40,394	609,547	694,475
Ditto, 10 to 65 kW	47,559	933,439	849,793
Ditto, 65 to 200 kW	97,829	491,561	589,043
Ditto, over 200 kW	129,398	1,932,214	2,627,077
Spark ignition engine driven	11,338	111,500	123,301
Steam turbine driven	149,051	468,561	846,322
Other prime mover driven	5,979	633,382	332,448
Generators	105,617	1,357,552	1,374,930
Parts of generators	191,948	2,371,533	2,721,256
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ¼ h.p.	109,290	1,068,245	1,232,039
Over ¼ but under 1 h.p.	32,089	292,338	365,367
1 h.p. to 250 h.p.	220,973	2,376,194	2,159,271
Over 250 h.p.	14,771	792,865	423,352
Railway, tramway and trolley-bus motors complete and parts of all motors	110,242	938,286	811,127
Motor starting and controlling gear	98,949	1,211,230	1,153,804
	1,365,427	15,588,447	16,303,605
Converting machinery	6,384	167,803	254,132
Mercury-arc rectifiers	19,636	328,068	368,183
Transformers for lighting, heating and power (incl. coils)	424,981	6,137,116	5,230,541
Switchgear and switchboards (not telegraph or telephone)	776,714	7,910,945	7,513,477
	1,227,715	14,543,932	13,366,333
Primary batteries:			
Lighting	49,458	407,225	415,725
Radio	150,660	879,867	1,010,371
Other	26,123	270,736	225,708
Parts (excl. carbons)	10,660	328,627	181,359
Lamps:			
Filament, exceeding 24 V	45,876	439,643	524,165
Ditto, under 24 V	24,009	169,618	184,309
Discharge lamps, fluorescent tubes, etc.	51,902	361,727	406,726
Other lamps	4,886	165,402	75,879
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilizing and cold cathode valves, magnetrons, klystrons*	12,001	—	136,524
Cathode-ray tubes	17,225	58,120	66,559
Other valves (not X-ray)†	165,551	982,740	1,044,657
Radio and television transmitters	29,448	398,864	382,914
Commercial radio and radar equipment	837,712	5,974,841	5,939,401
Domestic radio receivers, mains	105,232	992,288	962,930
Ditto, battery	64,178	315,297	397,237
Ditto, other (incl. car)	15,202	68,825	32,980
Radiograms	46,040	216,648	283,401
Television sets	5,880	101,019	53,773
Public address equipment	60,910	362,366	479,594
Sound reproducing app., n.e.s.	13,428	126,985	130,669
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	475,178	3,398,610	3,490,348
	1,847,985	12,996,603	13,500,987
Telegraph and telephone installations	260,697	3,740,399	3,891,088
Telephone instruments, separately consigned	76,922	720,230	483,092
Telegraph and telephone parts	276,121	2,718,842	2,816,179
Line apparatus for long distance commun.	83,990	975,284	469,159
	697,730	8,154,755	7,659,518

Class	June, 1955	Six months ended 30th June, 1954	Six months ended 30th June, 1955
	£	£	£
Cookers	39,509	400,602	772,054
Toasters	28,899	104,127	192,541
Other cooking apparatus	15,504	165,154	173,076
Parts and accessories	50,253	232,550	399,715
Space heating appliances	20,910	214,963	240,393
Water heating appliances	19,626	158,293	177,750
Other heating appliances	18,217	212,912	171,746
Parts and accessories	61,455	280,704	395,775
Irons	71,670	381,004*	625,059
Arc welding equipment, a.c.	20,775	226,404	184,887
Ditto, d.c.	15,102	283,190	169,881
Resistance welding equipment	4,947	113,206	116,962
Electric furnace plant*	24,574	—	222,674
Magnetos, ignition	11,377	91,561	98,113
Sparking plugs	108,154	870,388	916,108
Elec. appliances for aeroplanes, n.e.s.	121,054	1,190,905	1,133,548
Ditto, for motor vehicles, n.e.s.	258,331	1,398,634	1,788,908
Ditto, for cycles, n.e.s.	52,675	499,072	423,648
Signalling app. (incl. traffic signals)	24,529	344,693	285,699
Industrial radio-frequency equipment	7,019	133,238	86,851
Bell app. (not telegraphic or telephonic)	6,092	48,620	51,845
Instruments, commercial	80,283	896,383	824,787
House service meters (not prepayment)	44,236	723,876	586,645
Ditto, prepayment and parts of all house service meters	9,095	93,887	120,935
Electro-medical apparatus (not X-ray)	35,733	275,270	263,471
X-ray apparatus (excl. tubes and valves)	77,769	283,946	376,254
Vacuum tubes	19,650	119,215	139,037
Desk fans	12,925	208,616	135,382
Ceiling fans	38,843	624,542	523,126
Parts of fans*	3,276	—	37,247
Vacuum cleaners	85,124	1,085,118	792,226
Floor polishers	76,881	675,093	514,147
Food mixers	38,203	282,834	277,338
Hair clippers and dry shavers	69,173	465,817	461,421
Other portable appliances	32,371	153,242	280,951
Parts	55,068	413,713	439,506
Portable elec. tools (not saws) and parts	120,351	921,543	1,083,846
Cables and wires:			
Telegraph and telephone, submarine	31,618	424,426	482,943
Ditto, other	445,025	2,130,754	2,915,195
Cotton, silk or art. silk insulated	39,803	237,238	286,907
Enamel, glass or asbestos insulated	42,968	416,675	433,450
Paper insulated	397,940	3,453,914	3,504,831
Rubber insulated	288,673	2,398,265	2,820,836
Thermoplastic insulated*	28,842	—	415,623
Other	161,955	1,470,989	1,121,067
	1,436,824	10,532,261	11,980,852
Accumulators for motor vehicles	60,463	943,900	847,747
Ditto, traction	6,117	148,784	90,010
Ditto, radio and other portable	54,154	178,171	361,286
Ditto, other	16,260	337,010	136,689
Parts and accessories	54,807	367,886	494,615
Elec. porcelain, etc. (incl. insulators)	56,522	541,466	525,712
Insulating cloth and tape	44,321	294,002	358,290
Other insulating material	63,623	441,399	541,594
Permanent magnets	32,065	231,275	276,238
Radio, telegraph and telephone testing equipment, n.e.s.	60,573	193,822	256,105
Scientific elec. instruments (not telegraphic or telephonic)	190,837	1,193,361	1,443,999
Electrical machinery, n.e.s.	52,151	756,807	521,051
Electrical apparatus and appliances, n.e.s.	408,004	3,333,662	3,403,895
TOTAL	9,818,805	88,373,702	90,587,320

* Not separately distinguished before 1955. † The 1954 and 1955 figures are not completely comparable.

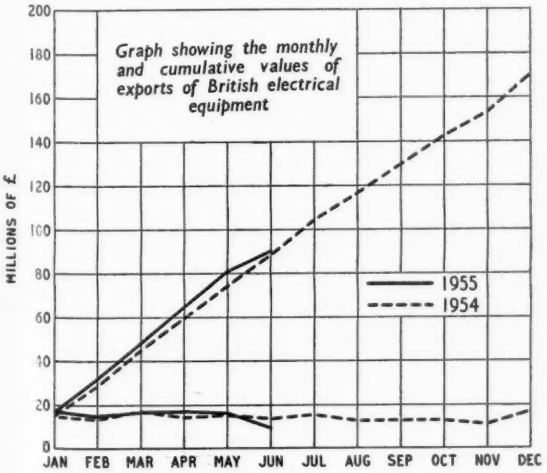
TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	June, 1955	Six months ended 30th June, 1954	Six months ended 30th June, 1955
	£	£	£
Channel Islands	45,221	312,583	298,778
Gibraltar	6,597	50,334	126,358
Malta and Gozo	15,316	313,178	286,568
Cyprus	45,122	409,829	567,231
Sierra Leone	7,064	80,122	150,296
Gold Coast	81,648	598,367	755,744
Nigeria	140,771	880,086	1,442,782
Union of South Africa	980,634	9,624,995	9,196,123
Rhodesia and Nyasaland	292,276	1,907,277	2,268,766
Tanganyika	20,466	333,652	451,217
Kenya	67,260	887,861	892,376
Uganda	8,289	412,862	503,446
Mauritius	21,484	146,957	188,104
Aden	16,175	598,598	271,901
Bahrain, Qatar and Trucial Oman	28,861	767,673	474,227
Kuwait	50,217	856,119	530,169
India	696,427	7,695,323	7,479,551
Pakistan	357,649	3,097,564	1,983,116
Singapore	153,490	1,569,919	1,895,542
Federation of Malaya	102,611	1,356,850	1,352,370
Ceylon	53,305	746,678	650,466
British North Borneo	6,543	179,198	132,684
Hong Kong	60,264	920,171	871,080
Australia	1,116,064	9,114,432	9,736,616
New Zealand	562,416	4,799,257	6,310,030
Canada	220,368	3,322,809	3,275,775
Jamaica	70,166	378,768	472,261
Barbados	2,178	119,860	97,753
Trinidad	17,419	493,236	479,074
British Guiana	13,753	221,810	280,516
Anglo-Egyptian Sudan	47,338	616,108	514,845
Other Commonwealth countries	84,294	730,876	884,702
Irish Republic	263,417	1,602,977	1,895,489
Soviet Union	267,430	1,248,640	1,121,292
Finland	24,868	676,397	601,323
Sweden	239,214	2,130,952	1,963,714
Norway	257,021	1,452,782	1,838,117
Iceland	6,489	83,586	62,164
Denmark	155,537	1,109,391	867,935
Poland	26,170	468,723	134,936
Western Germany	163,196	664,621	908,529
Netherlands	492,466	3,366,751	3,232,413
Belgium	227,466	1,610,037	1,345,878
France	234,598	1,880,742	1,550,284
Switzerland	87,501	549,578	485,240
Portugal	110,576	1,349,416	1,378,822
Spain	46,420	1,413,877	853,663
Italy	165,994	1,400,038	1,279,388
Austria	78,408	443,096	268,295
Yugoslavia	15,213	702,316	366,644
Greece	52,926	434,054	577,787
Roumania	171	1,662	943
Turkey	41,911	341,666	567,006
Belgian Congo	15,443	177,523	176,107
French Morocco	23,303	161,680	176,253
Portuguese East Africa	9,821	134,689	110,525
Syria	13,787	148,783	176,881
Lebanon	47,757	217,350	195,389
Israel	19,558	203,971	211,911
Jordan	22,189	133,074	169,816
Egypt	82,203	580,124	788,557
Libya	5,581	55,091	88,992
Saudi Arabia	42,421	335,857	456,712
Iraq	172,823	1,396,390	1,305,692
Iran	41,056	196,025	382,529
Burma	31,787	755,225	947,842
Thailand	124,163	837,989	844,450
Indonesia	15,327	252,530	144,619
Japan	72,208	232,634	539,383
United States of America	371,462	1,570,223	2,220,730
Cuba	12,784	126,833	131,353
Mexico	28,404	134,856	175,447
Colombia	10,596	364,626	474,922
Venezuela	37,040	1,004,984	1,487,398
Peru	11,600	217,121	185,607
Chile	2,199	183,267	187,790
Brazil	12,963	563,369	225,013
Uruguay	17,586	413,116	228,935
Argentine Republic	93,407	512,874	943,764
Other foreign countries	132,659	988,844	1,490,374
TOTAL	9,818,805	88,373,702	90,587,320

£2,220,730 against £1,570,223 in the first half of last year and £1,079,635 in the corresponding period of 1953, a very satisfactory achievement in a difficult market. Exports to the Soviet Union were a little under those in the first half of last year, but in June they were worth £267,430 (against £60,825 in June, 1954).

In addition to the goods in the electrical division of the Board of Trade returns, the following appear in other sections and are not included in our tables:—Electrically operated washing machines, not exceeding 150 lb net weight: June, £254,263 (£250,641); half-year, £1,616,874 (£1,699,532). Ditto, 150-250 lb: June, £60,531 (£133,943); half-year, £690,531 (£718,954). Parts of electrically operated washing machines: June, £20,576 (£51,430); half-year, £332,227 (£380,535). Electric locomotives: June, £191,899 (£180,846); half-year, £1,050,605 (£1,270,548). I.c. engine locomotives with electrical transmission: June, £116,837 (£497,361); half-year, £2,225,509 (£1,644,461).

In contrast to exports, imports of electrical equipment in June remained slightly higher than a year ago (£1,996,944 compared with £1,945,009) although less than in May (£2,296,806). The Netherlands (£559,754) and the United States (£417,977) were the main suppliers, followed by Western Germany (£360,923). The bulk of electrical imports were again in the radio class, purchases of which amounted in value to £1,169,709; this brings the total for the six months up to £6,019,235 against £3,857,788 in the first half of 1954.



Belfast Television Station

IN a one-storey instrument room on the top of 1,200ft high Divis Mountain, 3½ miles west of Belfast, Sir Harry Mulholland, chairman of the B.B.C. Northern Ireland Advisory Council, on 21st July officially brought into service the new permanent Divis television transmitter. Among those present were Sir George Barnes, director of B.B.C. television, and Mr. R. T. B. Wynn, chief engineer, B.B.C. The new Divis station has 30 times the effective radiated power of the temporary Glencairn transmitters and will greatly extend the area of good television reception in Northern Ireland.

The main transmitters, both vision and sound, have been designed and manufactured by Marconi's Wireless Telegraph Co., Ltd. In conformity with standard Marconi practice, the 5 kW vision transmitter is designed to handle colour transmissions as well as black and white, although, of course, there is no indication that the B.B.C. will use the colour facility in the foreseeable future. The company was also responsible for the manufacture of the three-stack super-turnstile aerial array which, used in conjunction with the main vision transmitter, gives an effective radiated power of approximately 12 kW.

INDUSTRIAL NEWS

Next Year's B.I.F.

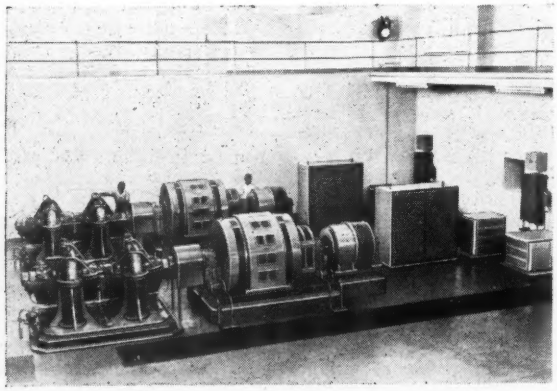
The electrical section of the British Industries Fair will be held in London next year in the Grand Hall, Olympia. As has already been announced, the Fair will be held in two parts—at Earls Court from 22nd February to 2nd March, and at Olympia, London, and Castle Bromwich, Birmingham, from 23rd April to 4th May. At Earls Court light consumer goods such as toys, fancy goods and jewellery will be on show. Technical products such as chemicals, office appliances, scientific instruments and electrical equipment will be on display at Olympia, while the engineering and hardware section will, as usual, be at Castle Bromwich.

At Olympia there will be 100,000 sq ft of exhibition space available for the display of a wide range of electrical products, from power station and industrial plant equipment to lighting and domestic appliances.

The decision to transfer the electrical section to London has been made in response to views expressed by large sections of the electrical industry. In planning the change British Industries Fair, Ltd., has had the support of the British Electrical and Allied Manufacturers' Association and of other manufacturers' organizations. This will be the first time that there has been an electrical section at the London B.I.F. since the Fair started in 1915. Although the electrical section will be at Olympia, those electrical concerns who still wish to exhibit in Birmingham will be able to do so.

Rhodesian Pumping Scheme

A new water supply system for the city of Salisbury, Southern Rhodesia, combined with a general irrigation scheme, uses Metropolitan-Vickers synchronous induction motors to drive all pumps. A pumping station near the Hunyani Poort dam delivers 400,000 gal per hour to the Warren Hills booster station against a head of 476ft and from there to Salisbury against a head of 335ft. At the pumping station 1,500 r.p.m., 1,250 h.p. driving motors are used and at the booster station 880 h.p. motors. Control arrangements maintain unity power factor from no-load to full-load. Supply is by 33 kV and 11 kV overhead lines, stepped down to 3·3 kV for the motors.



Interior of the pumping station for the Salisbury, Southern Rhodesia, water supply

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 16th July is deemed to be 162s 0d. The "cost of material" figures are:—

For electrical machinery and equipment the Board of Trade index figure published on 16th July is 180·1.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 163·8; blast furnaces and iron and steel smelting and rolling (40 and 41), 147·7. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 15th July) is 4s 4⅛d per lb. Outstanding contracts covered by the B.O.T. intermediate products index: The index figure for intermediate products (16th July) is 374·1.

Industrial X-Ray Contracts

Both the English Steel Corporation, Ltd., and the United Steel Companies, Ltd., have awarded contracts to Marconi Instruments, Ltd., for the supply of 250 kV constant potential X-ray units to their works at Grimesthorpe and Distington respectively. The equipment for Grimesthorpe consists of a constant potential high-voltage generator, a control unit, an oil cooler, and an oil-cooled shock-proof tubehead with a special turntable mounting for fitting to a girder suspension system. The Distington equipment is generally similar, but is mounted on a specially designed two-ton trailer to permit the easy radiographic inspection of welds and castings, irrespective of size. The control unit is installed in a lead-lined protective compartment, while at the opposite end are the tubehead and tubestand. These equipments have a voltage range of from 30 to 250 kV, enabling steel up to 4in thick to be penetrated.

London–Gibraltar Cable

A cable ship operation carried out in the Western Approaches to the Channel on 21st July on one of the two submarine cables directly linking Porthcurno, near Land's End, with Gibraltar, on the eastern cable route to Australia and the Far East, is expected to increase its word-carrying capacity by 50 per cent. A submarine telegraph repeater was inserted in the cable by the Cable & Wireless, Ltd., cableship *Recorder* 150 miles out from Porthcurno. This is the first telegraph repeater to have been put in operation in any of the company's submarine cables. A similar repeater will be inserted at the Gibraltar end of the other direct Porthcurno-Gibraltar cable later in the year. These repeaters are capable of one-way working only, and will be used to work in opposite directions. In the event of an interruption of either cable, however, it will be possible to restore the other to two-way working at the original, lower speed by switching the repeater out of the circuit.

Industrial Safety

The Royal Society for the Prevention of Accidents is organizing a national industrial safety week from 24th to 29th October next. The object of the campaign is to encourage all workers, and particularly young workers, to start safety habits. During the launching week of the campaign it is hoped to introduce suitable slogans into every factory, large or small, throughout the United Kingdom. There are some fifty local industrial accident prevention groups who will be organizing special functions in connection with the campaign, in which many of them will be supported by the local civic head and Chamber of Commerce. Works safety officers will carry the campaign into their own factories.

Film Presentation

To achieve its maximum impact a film must be well presented to the public for whom it has been designed. During the post-war years the use of 16 mm films for a great diversity of purposes has steadily increased, but the simplicity of operation of the 16 mm projector has proved as much

a liability as an asset, for all too often the ability to thread a film and manipulate the switches is considered sufficient qualification for the proper presentation of 16 mm films. The Council of the British Kinematograph Society realized that the situation was one that could do much harm to the industry, and a Committee was formed to investigate the problems involved. A report with recommendations and advice on all matters associated with the presentation of 16 mm films has now been published under the title "Good Presentation." It discusses and makes recommendations on the subjects of training for projectionists, the maintenance of films and equipment, and operating conditions and requirements. Copies (price 1s 6d) are available from the Society, 164, Shaftesbury Avenue, London, W.C.2.

Garcke's Manual

The fifty-second edition of "Garcke's Manual of Electricity Supply" is similar in arrangement to previous issues, except that, in consequence of the setting up of the South of Scotland Electricity Board, all particulars of the Scottish Electricity Boards have been concentrated in a new section. The data includes a general survey of electricity supply in Britain, in which reference is made to the generation of electricity by nuclear energy, and a short article outlines the ten-year programme of development to be pursued in this new field announced by the Minister of Fuel and Power. As in previous issues details are given of the constitution, organization and generating stations of the C.E.A., and there are sections covering electricity distribution and supply, and electrical and allied manufacturing companies. There is also a comprehensive directory of executive personnel. The Manual is available from Electrical Press, Ltd., price £3 17s 6d net, carriage paid.

I.H.V.E. Examinations

Commencing in 1957, the present Section A of the examinations of the Institution of Heating and Ventilating Engineers will be superseded by the Engineering Institutions' Part 1(a) and Part 1(b) examination, except that English will be excluded. The subjects for the new Section A will then be: Mathematics; applied mechanics; principles of electricity; heat, light and sound; and engineering drawing. There will be no optional subjects.

Electrical Standards and Metering

A special exhibition was opened at the Science Museum, London, to coincide with the recent meeting of the International Electrotechnical Commission and will remain open until 31st October. Although the exhibition is of particular interest to those concerned in the problems of metering bulk supplies of electrical energy to large industrial commercial undertakings, it is intended also for the less specialized visitor and serves to demonstrate the care which is devoted to the accurate calibration of electricity meters.

One object of the exhibition is to show the origin and derivation of the various electrical units. An exhibit of particular interest is the complete set of the original B.A. units of resistance which were made in 1864 for the British Association and constitutes the oldest set of accurate electrical standards now in existence. These B.A. units have been installed for many years in the National Physical Laboratory. It is now hoped that they will be presented formally to the Science Museum. Admission to the exhibition is free.

Lighting Fittings Exhibition

An exhibition of contemporary and traditional electric lighting fittings of Danish design was held last week at the Mostyn Hotel, Portland Street, London, W.1, being opened by the Danish Ambassador.

On view were examples of picture lighting fittings, piano lights, hospital fittings and lantern types, including several which were to be seen in this country for the first time.

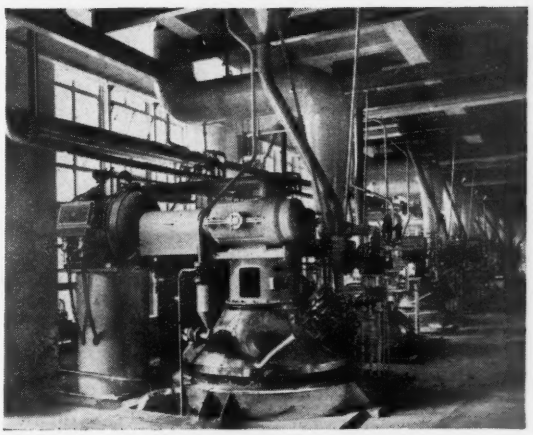
The fittings are the products of A/S H. A. Gruberts Sonner, Copenhagen, and the sole selling agents in the United Kingdom are the W. W. Trading Co., Ltd., 156, Camden High Street, London, N.W.1.

A.S.E.E. Branch Meeting

The North London Branch of the Association of Supervising Electrical Engineers is holding a meeting on 3rd August at the "Queen's Head," 677, Green Lanes, Harringay, N.4 (7.45 p.m.), when there will be a discussion on "Interesting Electrical Problems."

Grease Manufacture

At the Birkenhead grease plant of the Vacuum Oil Co., Ltd., "kettles" varying in capacity from 2,000 lb to 15,000 lb embody contra-rotating paddles for mixing the oil and soap of which the grease is composed. The upper portion of a kettle, together with the motor drive to the paddles, can be seen in the foreground of the accompanying photograph. The motors are of the Metropolitan-Vickers three-speed, high-torque, squirrel-cage type, of from 20 h.p. to 75 h.p. according to the capacity of the kettle. To cater for the widely varying load, which is dependent on the consistency of the grease in the kettle, the horsepower and speed of the individual motors are variable.



Metropolitan-Vickers three-speed high-torque squirrel-cage motors driving contra-rotating paddles in a grease manufacturing "kettle" at the Birkenhead plant of the Vacuum Oil Co., Ltd.

Cryselco Diamond Jubilee

To commemorate its diamond jubilee, Cryselco, Ltd., has issued a set of twelve pictures, in a pocket size folder, illustrating interesting events of sixty years ago. These include the construction of the City and Waterloo Underground Railway, the Marchese Marconi at a tape-recording machine of his invention, the "Cinematographe" machine of Louis and Augusta Lumiere, and a portrait of Röntgen, the discoverer of X-rays.

Communications for the Gold Coast

An order has been placed with Marconi's Wireless Telegraph Co., Ltd., by the Gold Coast Posts and Telecommunications Department for the supply and installation of a twin-path, 24-channel (per path) v.h.f. radio communications service from Kumasi to Takoradi, via Mpraeso, Koforidua, Mampong (Akwapim), Accra, Winneba and Cape Coast. The terminal at Takoradi will be accommodated in a new telephone exchange.

The equipment to be supplied includes 20 Marconi multi-channel terminal units type HM105, and four multi-channel repeater units type HM155, together with power supplies, ancillary equipment and spares. A number of channels of each radio path are to be extracted at three points, namely at Koforidua, Winneba and Cape Coast, so as to enable local telephone lines in those areas to link with the trunk route. At all repeater stations the equipment will work entirely unattended. The aerials to be used will be mounted on steel towers, which, in some instances, are to be 250ft in height.

This project will link with a twin-path, 12-channel (per path) service

between Tamale (in the north), Palbusi, Salaga, Prang, Abuo, Ejura, Mampong and Kumasi, the supply and installation of which is already being carried out by Marconi's. In this instance one channel of each radio path is being extracted at Salaga, Prang, Ejura and Mampong. The complete scheme will thus provide a valuable aid to the Gold Coast's expanding export market, not only by giving facilities for internal communication, but also by bringing the hinterland into direct radio contact with the capital cities of the world, via the Cable & Wireless stations on the coast.

Educational

The prospectus for 1955-56 of the Department of Electrical Engineering and Applied Physics at the South East London Technical College is now available. Special courses on electrical engineering economics, operational calculus with applications to electric circuit theory, communication engineering economics, electric power transmission calculations, and high voltage engineering begin in October next. Particulars of these courses and copies of the prospectus can be obtained from the Department of Electrical Engineering, Lewisham Way, S.E.4.

A course of lectures on the theory of microwave circuits will be given at the Battersea Polytechnic by Dr. D. R. Workman, commencing on 12th October. Particulars can be obtained from the Polytechnic, Battersea Park Road, S.W.11.

The prospectus of day and evening courses for the 1955-56 session is now available from the Sir John Cass College, Jewry Street, London, E.C.3.

Australian Plant Order

An order valued at over £285,000 has recently been received by the Metropolitan-Vickers Electrical Co., Ltd. (through Australian General Electric Pty., Ltd.) from the State Electricity Commission of Victoria for a 20 MW 3,000 r.p.m. low-pressure turbine-generator set for installation at the Commission's brown coal briquetting factory at Morwell. The set will include a double-flow low-pressure turbine designed to use surplus exhaust steam from two Metropolitan-Vickers 30 MW back-pressure turbine-generator sets already installed at the same station.

Originally it was planned to use the exhaust from the larger turbines as process steam in the briquetting plant, but owing to financial restrictions the construction of this plant will not go forward as quickly as anticipated; it was therefore decided to convert the resultant surplus steam into electrical energy which will be fed into the Commission's system. Approximately 420,000 lb/hr of surplus steam will be passed into the new turbine at 27½ p.s.i.g. and 299 deg F. The turbine will be coupled to an air-cooled a.c. generator designed for a power factor of 0·7; generation will be at 11 kV 50 c/s. Both the turbine and the generator will be made at the Trafford Park works. The associated condenser, operating at a vacuum of 27½in Hg, and the feed water heaters will be manufactured to Metropolitan-Vickers design in Australia.

Electrical Industries Club

The rules and regulations of the Electrical Industries Club as agreed at the annual general meeting in April are now available in printed form and a list of members has also been issued. Copies may be obtained from the hon. secretary, Mr. A. S. Lowe, Kingsway House, Kingsway, London, W.C.2.

Transformers for the U.S.A.

On 19th July last three 230 kV Ferranti transformers forming the third 100,000 kVA bank for the Garrison Dam project, North Dakota, U.S.A., left the company's transformer factory by road for shipment at Manchester Docks. Ferranti, Ltd., have now supplied a total of nine 33,333 kVA, single-phase, 60 c/s, 13·2/230 kV generator transformers forming three 100,000 kVA, 3-phase banks, to the U.S. Army Corps of Engineers for installation in the Garrison Dam power plant. The total value of the contract is $880,000.

Bakelite to Market Polyethylene

Bakelite, Ltd., has concluded an agreement with Union Carbide, Ltd., under which Bakelite will market polyethylene plastics produced in the United Kingdom by Union Carbide. The sales organization of Bakelite will be available for sales of this polyethylene both at home and in export markets. Union Carbide, Ltd., is constructing a plant at Grangemouth in Scotland to produce polyethylene of the same quality and types as that now made in the U.S.A. by the Union Carbide & Carbon Corporation. The plant is expected to come into operation in the third quarter of 1957, but in the meantime Bakelite, Ltd., will have available quantities of imported polyethylene for sales development purposes.

Royal Welsh Show

A joint display by the South Wales Electricity Board and the British Electrical Development Association was one of the attractions at the recent Royal Welsh Show at Haverfordwest. The display included farm and agricultural equipment and the Board's new slogan, "Electricity—All Ways," was emphasized by a sign post which towered above the display.

Equipment for Salford Technical College

The Metropolitan-Vickers Co., Ltd., has offered to provide full equipment for extensions at the Royal Technical College, Salford, in the advanced technology laboratory, the general electrical laboratory and the general machine laboratory and to supply equipment for the welding laboratory. The cost is estimated at between £15,000 and £20,000.

Cookers for Singapore

A bulk order for 3,000 standard European pattern three-plate cookers, valued at £75,000, has been placed by the Singapore City Council with the General Electric Co., Ltd.

Trade Announcements

The **Brightside Foundry & Engineering Co., Ltd.,** announces the formation of a new wholly-owned subsidiary company, the Brightside Heating & Engineering Co., Ltd., which has been formed to take over the continuously expanding activities of its heating, air treatment and pipework division. Mr. Ambrose Firth has been appointed chairman and Messrs. T. C. Firth, W. S. Richards and W. B. James, directors.

P. W. Allen & Co., 253, Liverpool Road, London, N.1, have been appointed United Kingdom agents for "Bodson" endoscopes, which permit critical examination of interior surfaces where normal direct vision (or the use of mirrors) is impossible, e.g., aircraft engines and structures (corrosion or cracks in bolt holes), boiler high pressure drums, pressure bottles and vessels, rigid and flexible pressure pipes and tubes of all descriptions. The range extends from $\frac{5}{32}$in dia. by 4in long up to 23ft long at $1\frac{3}{16}$ dia.

Annual Holidays

The works of Line Equipment, Ltd., Bridgend, Glam, are closing to-day (Friday) for the annual holidays and will reopen on 16th August.

CATALOGUES & LISTS

ACCESSORIES. — Illustrated broadsheet giving details and prices of the complete range of "Nettle" electrical accessories.—**Nettle Accessories, Ltd.,** Harper Road, Wythenshawe, Manchester.

ALUMINIUM. — "The Endurance of Aluminium"—an illustrated folder describing the capabilities of aluminium.—**Aluminium Union, Ltd.,** The Adelphi, London, W.C.2.

ARMATURE WINDING MACHINES.—4-page folder on "Quickway" adjustable armature winding machines with particular emphasis on models "1B" and "2B."—**Midland Dynamo Co., Ltd.,** 64, Belgrave Gate, Leicester.

CONDENSERS. — Illustrated technical leaflets on tantalum anode condensers.—**Telegraph Condenser Co., Ltd.,** North Acton, London, W.3.

DOMESTIC APPLIANCES. — 28-page illustrated, priced, catalogue of "Swan Brand" electrical appliances and ground-base aluminium hollow-ware.—**Bulpitt & Sons, Ltd.,** Swansea Works, Birmingham, 1.

Priced leaflet covering "Hotpoint" rotary and table ironers.—**Hotpoint Electric Appliance Co., Ltd.,** Fletton, Peterborough.

INSULATORS.—Leaflet introducing the "Dimex" light weight, low capacity, puncture proof insulator.—**Electric Transmission, Ltd.,** Etruria, Stoke-on-Trent, Staffs.

THERMOCOUPLES.—Technical leaflet describing the company's ranges of vacuum and air thermocouples.—**Ormandy & Stellery, 56, High Street, Brightlingsea, Essex.**

GENERATION AND DEVELOPMENT

Visitors to the Eastern Electricity Board's stand at the recent Bedfordshire Agricultural Show. Left to right: Alderman W. J. Bennett, C.B.E., J.P. (member of the Board and chairman of the Consultative Council), Mr. R. Whitlock (B.B.C. broadcaster and Wiltshire farmer), Mr. H. Knocker (machinery advisory officer, Bedfordshire Agricultural Executive Committee), and Mr. S. F. C. Whitmore (manager, Chilterns Sub-Area, Eastern Electricity Board)

Seven More Power Stations to Burn Oil

Lord Citrine, chairman of the Central Electricity Authority, and Mr. C. M. Vignoles, managing director of Shell-Mex & B.P., Ltd., last week signed a contract for the supply of fuel oil by the company to a further seven of the Authority's power stations. These stations are Ince, Bromborough, Cliff Quay (Ipswich), Carrington (Manchester), South Denes (Great Yarmouth), Belvedere, and a projected new station on the Thames Estuary. In addition, the Bankside "B" power station, which is already supplied with fuel oil by the company, is brought under the new agreement.

The supply of fuel oil by Shell-Mex & B.P., Ltd., will begin immediately in respect of the Bankside station, but will not reach significant quantities in the case of the other stations until 1958. When the maximum supplies under the contract are being consumed, they will be equivalent to nearly 5 million tons of coal per annum. This is additional to the similar coal saving which will result from the use of fuel oil supplied under the agreement concluded with the Esso Petroleum Co., Ltd., last month.

An interesting feature of this contract is that it provides for the use at two of the stations selected of low flash-point fuel oil. The significance of this is that with the increasing rate of demand for fuel oil relative to other fractions of crude oil, inevitable difficulties of refinery balance arise. The use of low flash fuel oil, by permitting the incorporation of fractions of a wider range in the fuel, will help to ease these difficulties and provide greater flexibility at the refineries.

Power Plant Extensions

New plant installed in the Central Electricity Authority's generating stations during June included a 360,000 lb/hr John Thompson boiler at Brimsdown "B"; a 30 MW British Thomson-Houston set and a 300,000 lb/hr Clarke, Chapman boiler at Goldington; a 240,000 lb/hr Babcock & Wilcox boiler at Staythorpe "A"; a 60 MW C. A. Parsons set and a 550,000 lb/hr Clarke, Chapman boiler at Stella North; a 320,000 lb/hr B. & W. boiler at Brighton "B"; a 60 MW Metropolitan-Vickers set and a 240,000 lb/hr B. & W. boiler at Carmarthen Bay; a 180,000 lb/hr Mitchell boiler at Doncaster "B"; a 150,000 lb/hr Simon Carves boiler at Blackburn; a 30 MW Parsons set at Hackney "B"; a 12·5 MW Brush set at Cowes and a 2 MW Mirrlees, Bickerton & Day diesel set at Alderley Edge. In the South of Scotland Electricity Board's area a 30 MW English Electric set and a 180,000 lb/hr boiler were installed at Clyde's Mill.

Rugeley "A" and Agecroft "B" Power Stations

The Central Electricity Authority has received the consent of the Minister of Fuel and Power to the establishment of a new power station at Rugeley, Staffordshire. To be known as the Rugeley "A," it will have an installed capacity of 240 MW provided by four 60 MW turbo-generator sets each steamed by a boiler unit having an evaporative capacity of 550,000 lb/hr.

Consent has also been received for the extension of the Agecroft "B" power station at Salford by two 120 MW turbo-generator sets and two boiler units each having an evaporative capacity of 860,000 lb/hr. This plant will increase the installed capacity of the station to 345 MW.

Boards' Sales in June

Complementary to the details of electricity output published last week, the accompanying table analyses the sales of each of the Area Boards last month. The national figures show an increase over June, 1954, of 11 per cent, but when corrected for weather conditions and working days (27·77 against 27·11 in June, 1954) the increase is 9·6 per cent.

Farmers Object to Tyrone Scheme

Fifty Co. Tyrone farmers whose lands will be affected by the work have lodged protests with the Northern Ireland Ministry of Commerce against a proposed hydro-electric scheme on the River Mourne, at Ardstraw. The farmers have appointed a deputation to ask Tyrone County Council to rescind its approval of the scheme.

Supplies to Bristol Estates

The South Western Electricity Board is carrying out a £140,000 development scheme for the provision of electricity supplies to the rapidly expanding housing estates in the Bristol East District. In the next three years it is expected that some 2,500 families will be housed on the new estates now being built or planned in the Downend area. Supply networks totalling over 16 miles of mains are being constructed and 16 electricity substations equipped.

It is hoped to provide electricity supplies to over 1,000 new houses in the district this year, many of them on the large private estate at Bromley Heath, where almost all the houses will be fitted with immersion heaters and wiring circuits will be provided for

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for June (million kWh)			Twelve Months Totals Ended 30th June (million kWh)		
	1954	1955	Inc. or Dec. %	1954	1955	Inc. or Dec. %
London	385·3	418·3	+ 8·6	5,830·4	6,360·4	+ 9·1
South Eastern	240·6	258·0	+ 7·3	3,487·7	3·833·0	+ 9·9
Southern	293·3	321·8	+ 9·7	4,093·9	4,626·9	+13·0
South Western	153·1	168·5	+10·1	2,034·1	2,396·1	+17·8
Eastern	399·3	438·2	+ 9·7	5,648·8	6,283·3	+11·2
East Midlands*	353·5	405·2	+14·6	4,806·1	5,418·9	+12·8
Midlands*	477·6	534·3	+11·9	6,492·3	7,210·8	+11·1
South Wales*	302·5	334·9	+10·7	3,745·8	4,158·3	+11·0
Merseyside and North Wales*	282·4	324·3	+14·8	3,664·6	4,211·4	+14·9
Yorkshire*	469·9	543·4	+15·6	6,305·8	7,023·3	+11·4
North Eastern*	281·5	310·7	+10·4	3,761·3	4,114·4	+ 9·4
North Western*	521·7	556·3	+ 6·6	7,070·4	7,675·5	+ 8·6
Total all Area Boards	4,160·7	4,613·9	+10·9	56,941·2	63,312·3	+11·2
Direct Supplies by Central Authority	94·3	109·1	+15·7	1,060·9	1,521·1	+43·4
Grand Total	4,255·0	4,723·0	+11·0	58,002·1	64,833·4	+11·8
Mainly Industrial Areas*	2,689·1	3,009·1	+11·9	35,846·3	39,812·6	+11·1
Mainly Non-Industrial Areas	1,471·6	1,604·8	+ 9·1	21,094·9	23,499·7	+11·4

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

electric cookers. More than 54 per cent of the houses completed to date on this estate already have electric cookers installed.

Electricity Tariff Revisions

Details of proposed tariff revisions to meet the increased cost of coal were given to the North Western Electricity Consultative Council last week by the chairman of the Board, Sir Joseph Hallsworth. Under the standard domestic tariff the number of kWh a quarter at the primary rate (5d) for each room group will be increased by eight and the running charge of 0·875d/kWh will be raised to 0·9d (in the case of prepayment supplies there will be an increase from 36 to 44 in the number of primary kWh charged at 6d). Similar increases will apply to the standard farm tariff. The standard industrial tariffs are not being changed but the ceiling prices for tariffs "M" and "Q" will be raised from 2d to 2·5d and from 2·15d to 2·65d per kWh respectively. The fixed charges of two-part tariffs for combined domestic and commercial premises not subject to fuel price adjustment are to go up by 10 per cent and the running charges from 0·875d to 0·9d. In the case of two-part tariffs for other purposes there will be an increase of 0·125d/kWh. Flat and block rate tariffs for unrestricted supplies for motive power, heating, cooking, etc., will be adjusted by a like amount, subject to the maximum not exceeding 2·25d/kWh. The standard public lighting charges are to be advanced by approximately 12½ per cent. All other tariffs, with the exception of the lighting flat rate and restricted hour tariffs, will be revised so that where the flat rate or any "unit" rate in a block rate tariff is below 5d it will be increased by 0·125d, no resultant rate being less than 1·25d/kWh. The changes will take effect from the first meter reading following 30th September.

The Yorkshire Electricity Board, following a meeting last Friday to consider the increased coal prices, stated that these would cost the Board nearly £1,500,000 in the current financial year and about £2,200,000 in 1956-57. Industrial and other large consumers would automatically pay approximately 7½ per cent more under the fuel price adjustment clause, but it would be necessary for the Board to increase the charges to domestic and other consumers, taking into account the increases of over £1,000,000 a year in the cost of wages and materials which the Board had had to face since the present standard tariffs were introduced. Revisions designed to meet this situation would be forwarded to the Electricity Consultative Council for their comments. It was proposed that the increases should be brought into effect as from 1st October next.

New Southern Rhodesian Power Station

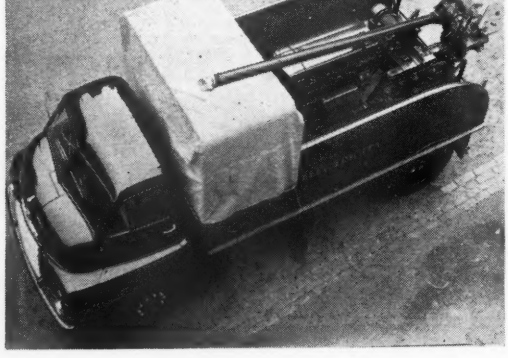
The city of Salisbury, Southern Rhodesia, has issued a booklet commemorating the recent opening of its No. 2 power station. The history of the undertaking is given from the time the first 187 kW diesel and suction gas plant was installed in 1918 to the first stages of the No. 3 station, now building, which will have an ultimate capacity of 180,000 kW. The completed No. 2 station has six turbo-alternators, two of 7,500 kW, two of 10,000 kW and two of 20,000 kW rating. All are of the single cylinder type running at 3,000 r.p.m. and generating at 11 kV. Steam conditions are 375 lb/sq in and 750 deg F. Nine boilers are installed, five of 87,500 lb/hr capacity and four of 110,000 lb/hr. The consulting engineers for the electrical and mechanical work were Messrs. Merz & McLellan.

Distribution Pole Erection

To drill holes in the ground for the erection of distribution poles, the S.M.T. Sales & Service Co., Ltd., has supplied to the South of Scotland Electricity Board a Cheshire-Highway earth boring machine mounted on a Bedford four-wheel-drive chassis/cab.

The machine is capable of drilling holes about 2ft in diameter and 7ft 6in deep in about three minutes. A self-contained winch on the earth borer converts the machine into a useful jib crane. Special removable cradles are provided so that the machine can also carry poles with it to the operating site and after drilling the holes, can lift and erect the poles into position. The special body is heavily strengthened at the rear to take the thrust of the big jacks which steady the vehicle during the drilling operations; and a locker and crew protection canopy are included in the equipment. The side guard rails to minimize body damage while passing through narrow gateways, and similar places, can be seen.

Earth boring rig for the South of Scotland Electricity Board



Rural Supplies in the Fens

On Wednesday last a comprehensive rural electrification scheme in North West Huntingdonshire was formally inaugurated, the switching-on ceremony being performed at Great Gidding. The scheme covers some 31 sq miles of rural territory in the Eastern Electricity Board's Fens Sub-Area (manager, Lt.-Col. A. E. Knights) and the total cost of the work, including reinforcement, has amounted to approximately £45,000. Supplies are given to ten villages and 65 farms, altogether 360 consumers being connected. Some 200 wayleave agreements were required. The project took 14 working weeks to complete, great advantage being derived from the centralized construction unit which facilitates the movement of gangs when necessary and the concentration of men and materials in one place. Two pot-hole boring machines averaged some 25 poles per day, including boring and erecting; in all 780 poles were erected.

New Service Centre

A new North Western Electricity Board service centre in the Market Place, Heywood, Lancashire, was officially opened on 15th July. The former undertaking's showroom in Heywood had to be closed down during the last war. The official opening was performed by Councillor P. O. Walker, Deputy Mayor of Heywood. Sir Joseph Hallsworth, chairman of the Board, and other officials were present.

Water Power in N.W. Canada

The feasibility of a major power development in Northern British Columbia and in the Southern Yukon is confirmed by Northwest Power Industries, Ltd. Field surveys and engineering studies during 1954, it is said, have "entirely confirmed the feasibility of the tentative plans developed the preceding year." The scheme, as now conceived, envisages diversion of the waters of the Yukon watershed by means of dams into huge natural storage basins at elevations above 2,000ft.

The report says it has been shown that a minimum of 4,300,000 h.p. can be developed in stages at two sites between the south end of Atlin Lake and the Taku River with the further possibility of an additional 500,000 h.p. on the Taku River itself.

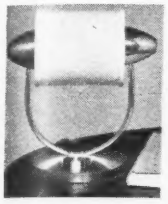
Argentine Plant Capacity

In his annual message to Congress, General Peron stated that the total capacity of generating plants in Argentina was now 700,000 kW, which it was hoped to increase by 350,000 kW within two years.

NEW ELECTRICAL EQUIPMENT

Bedside Lamp

A bedside lamp of modern design has just been placed on the market by DUNCAN, PARTNERS & PRICE, LTD., 55, Uxbridge Road, Shepherds Bush, W.12. The lamp is of aluminium construction with a finish of either anodized gold or metallic red, blue-green, and gun-metal stoved enamel.



Duncan Price bedside lamp

The shade is claimed to be one of the newest developments in home lighting, providing 75 per cent more illumination, and is constructed to give a glareless and whiter light. The switch is fitted in the base of the lamp and an ample length of p.v.c. covered flex is provided. The retail price is £1 1s 9d plus 3s 7d purchase tax in the United Kingdom.

Heating Appliances

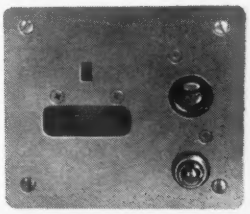
Two new additions to the domestic range of heating apparatus are announced by the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Tyseley, Birmingham, 11. The "Circulair" convector heater is compact and sturdily built and is easily transported from room to room. The 1 kW element is totally enclosed, thus rendering it safe for children, and the outer casing remains at a safe handling temperature. A deflector at the top directs the heat outwards and a light at the base reflects a warm glow through the grill. The "Circulair," which is finished in an attractive shade of bronze and has a black moulded lifting handle, is 22¼in high with a 7½in square base; it weighs 12¼ lb. The price is £3 8s plus £1 4s 10d purchase tax in the United Kingdom.

The "Memglo" is a new flat-bar type of fire constructed of sheet steel for lightness and strength. It is available in 1 and 2 kW sizes and the elements are shielded by a strong guard. The finish is mottled stone only. The respective prices are £2 2s plus 15s 4d purchase tax (1 kW) and £2 19s plus £1 1s 7d purchase tax (2 kW).

The M.E.M. "Circulair" 1 kW convector and the "Memglo" 2 kW model fire

Switch Sockets with Pilot Lights

To meet the demand for switch sockets and plugs with pilot lights, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is now producing flush and surface patterns both in 13 A and 15 A ratings. In these units, a Mutac a.c. switch and 3-pin plug, which in the 13 A unit is fused, are housed in a cast iron box. Fitted below the switch dolly is the red pilot light. This is a completely sealed unit housing a 200/250 V neon tube and resistor, the seal being made by swaging the red lens into a brass bezel finished to match the plate. The extremely long life of the neon tube makes it unnecessary to allow for lamp replacement. The units incorporating these pilot lights are of similar overall dimensions to existing standard Mutac switch sockets.



G.E.C. flush switch socket with pilot light

List prices of the 13 A 3-pin flush pattern (S.4564/2959) and surface pattern (S.4566/2959) switch socket and fused plug with pilot light are £1 12s each. The 15 A 3-pin flush pattern (S.4594/2886) and surface pattern (S.4596/2886) switch socket and plug with pilot light, are priced at £1 11s 8d each.

Lightweight Alkaline Battery

An ultra-lightweight, 24 V alkaline battery for emergency duties in high-speed aircraft has been developed by NIFE BATTERIES, LTD., Redditch, Worcs, in conjunction with the Ministry of Supply. It provides emergency power for turn and slip indicators and cockpit lighting. Weighing under 3 lb, its overall dimensions are only 4¼in by 4¼in by 3⅜in high. The battery is designed to operate without electrolyte leakage at altitudes of up to 60,000ft and its mechanical strength is sufficient to withstand stresses of 30G in any direction.

The battery consists of 21 nickel cadmium cells, type MP04, with a nominal capacity of 0·4 Ah. The emergency load amounts to 11 W for a minimum of 20 minutes—5 W for the turn and slip indicator and 6 W for the cockpit lighting. Assembled in high impact polystyrene containers, the cells are based on the standard Nife nickel cadmium design and the battery will perform its duties even after long periods of idleness in any climatic conditions from arctic to tropical with a margin of reserve sufficient to allow a final operating voltage in excess of the stipulated 21 V.

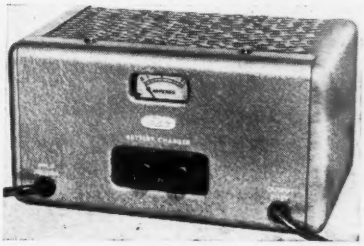
Nife 24 V alkaline battery

Battery Charger

A new family battery charger with a number of advantages over its predecessor and being cheaper in price is announced by the GENERAL ELECTRIC CO., LTD. The charger, which is suitable for 2, 6 or 12 V batteries (charging one, two, three or six cells), operates at a maximum charging rate of 2½ A, as opposed to the nominal current rating of 3 A in the earlier model. The front panel carries plugs and sockets for different battery voltages.

The lower output current has enabled the size of the double-wound transformer and selenium bridge rectifier, which ensure complete isolation from the mains, to be reduced so that a relatively greater cooling area is provided in the charger casing which is the same size as in the previous model. To dispense with the need for personal supervision, rotary resistance control has been superseded by a fixed ballast resistance in the circuit which limits the charging current and prevents possible damage to the unit or battery on charge. A simple easy-to-read meter is provided to give the maximum current setting. The charger, which is finished in hammered green enamel, has a full load consumption of 50 W. Dimensions are 9¼ by 5⅜ by 5 $\frac{13}{16}$ in. It weighs 7½ lb and is priced at £6 4s 6d.

G.E.C. family battery charger



Financial Section

STOCKS and SHARES

STOCK Exchange markets have been very flat. The early part of the week started off with a heavy fall in securities from one end of the House to the other. British Government stocks and industrial shares bore the main brunt of the selling. Anticipations of the Chancellor's statement on economic affairs looked for a further turn of the screw on money rates and credit. Few sections of the Stock Exchange escaped the effect of what Mr. Butler was expected to say, and prices were put down with an unsparing hand. The bullishness of the past few months was suddenly rent; but notwithstanding the severity of this week's decline, today's prices still compare favourably with those which ruled earlier in the year, when they were shaken, it may be recalled, by a rise in Bank Rate.

After the Slump

The Chancellor's speech proved to be less austere than, in advance, was anticipated. The prices on Monday night showed heavy falls on the day; but, in view of the likelihood of there being a recovery in the succeeding days, it has been thought advisable to give our quotations as for last Monday morning, when the Stock Exchange reopened after the week-end. These were followed, as already mentioned, by heavy falls, part of which may be wiped out by subsequent considerations.

G.E.C. Dividend

The final dividend of 9½ per cent declared by the General Electric Co., together with the preliminary profits statement for the year to March last, came well up to the best anticipations. The distribution compares with the figure of 8 per cent mentioned at the time of the "rights" issue of nearly two million new shares in February. It makes for the year a total of 14 per cent (the same rate, incidentally, as that paid by A.E.I.) which is covered fully three times over as a result of the rise of more than a million in the group net profit to nearly £3½ million (after tax of £3·6 million). Following the news the price of the shares crossed the £4 mark for the first time. In the subsequent reaction they came back to 73s 6d, but were still more than £1 above the quotations ruling earlier in the year. They stand now on a yield basis of about 3¾ per cent.

Pye Results

Although they fell back to 42s 6d, Pye 5s deferred shares showed a net improvement of about 5s in response to the brilliant preliminary results announced for the year ended last March. Comparison with previous figures is affected by the year's issues and acquisitions, but the virtual doubling of the trading profit, to £2·2 million, left no doubt about the success attending the group's expansion programme. The surplus is roughly halved by a tax charge of over a million. Ordinary capital is to be doubled by

The Week's Price Changes

Company or Board	Nom. Value	Middle price 25th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1955 Highest	1955 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	83⅛	−1	3	3	3 11 9	94⅞	83½
Brit. Elec. 1974/77	100	82½	−1	3	3	3 12 9	93⅞	83½
Brit. Elec. 1976/79	100	86½	−2	3½	3½	4 1 0	98¾	87½
Brit. Elec. 1974/79	100	98½	−2	4½	4½	4 6 3	109	99½
Overseas Electric Supply								
Calcutta Elec.	£1	22/-		6†	6†	5 9 0	22/6	20/9
East African Power	£1	24/-	−6d	7	7	5 16 9	24/6	19/9
Nigerian Elec.	£1	24/6		10	10	8 3 3	27/-	22/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	22/9	21/-
Perak Hydro-Elec.	£1	21/6		6	10	9 6 0	21/6	17/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/9	−6d	12½	17½	6 7 3	14/6	11/-
Aerialite	1/-	5/9		88⅛	88⅛	—	6/7	5/3
Allen, W. H.	£1	83/9		20	20	4 15 6	83/9	77/-
Aron Elec. Ord.	£1	61/3		20	15	4 18 0	63/9	55/6
Assoc. Elec. Ord.	£1	94/6	−6d	11¼	14	2 19 3	96/-	65/3
Automatic Tel. & El.	£1	78/3		15	15	3 16 9	79/6	69/-
Babcock & Wilcox	£1	95/6		12*	15	3 2 9	98/-	68/6
Baldwin, H. J.	2/-	5/6		20	20	7 5 6	5/6	4/4
Bakelite	10/-	33/6		12½	16	4 15 6	33/6	27/-
British Aluminium	£1	58/-	+4/-	10	12	4 2 9	58/-	35/3
B.I. Callender's	£1	55/-		10	10	3 12 9	55/3	44/9
B.I. Callender's 6% Pref. ...	£1	23/6		6	6	5 2 3	26/6	23/-
British Thermostat	5/-	35/-		27½	27½	3 18 6	35/-	22/6
British Vac. Cleaner	5/-	10/-		25	30	—	10/-	7/-
Brook Motors	10/-	45/-		20	20*	—	45/-	39/9
Brush Ord.	5/-	9/3		6	10	5 8 0	9/6	7/7
Bulgin, A. F.	1/-	8/-		30	45	5 12 6	8/-	4/-
Burco	5/-	18/9		35	25*	6 13 3	23/-	18/9
Chloride El. Storage "A" ...	£1	77/6		12½	17½	4 10 4	77/6	58/6
Clarke Chapman	£1	102/6		20	20*	3 18 1	102/6	68/9
Cole, E. K....	5/-	24/3	+9d	27½	17½*	3 12 3	25/6	18/3
Cossor, A. C.	5/-	13/3	+9d	10	10	3 15 6	14/-	8/9
Crabtree	10/-	33/-		17½	20	6 1 3	34/6	29/3
Crompton Parkinson Ord. ...	5/-	19/-		20	20	—	19/9	16/-
De La Rue	5/-	21/6	+9d	20	30	6 19 6	26/-	18/9
Decca	4/-	43/9x.d.		35	56¼*	—	48/9	31/-
Desoutter	5/-	35/-		20	25	3 11 6	35/-	25/6
Dewhurst	2/-	10/6		19	24	4 11 6	10/6	7/3
Dictograph Tel.	2/-	7/6		20	20	5 6 9	7/6	6/6
Dubilier Condenser	1/-	5/-x.d.		25	25*	5 0 0	5/7	3/10
E.M.I.	10/-	30/6		8	10	3 5 6	37/-	25/3
Electrical Components	5/-	21/3	−2/6	20	25	5 17 9	21/3	15/3
Elec. Construction	£1	35/9		15	8⅛*	4 15 0	41/3	31/6
Enfield Cable Ord.	£1	20/-		Nil	Nil	Nil	25/3	20/-
English Electric	£1	86/3	+3/9	10	12½	2 18 0	86/9	54/3
English Electric 3¾% Pref. ...	£1	14/9		3¾	3¾	5 1 9	16/9	14/9
Ericsson Tel.	5/-	44/6		25†	20†*	2 5 0†	46/6	29/-
Ever Ready	5/-	38/-		40	35*	4 12 0	38/-	22/3
Falk Stadelmann	£1	49/6	−1/-	15	15	6 1 3	52/6	43/9
G.E.C. Ord.	£1	77/6	+6/3	12½	14	3 12 6	80/3	51/3
G.E.C. 6½% Pref.	£1	25/-		6½	6½	5 4 0	28/4	23/6
General Cables	5/-	15/3	+3d	30	30	9 16 9	17/-	15/-
Greenwood & Batley	£1	57/6	+9d	17½	17½	6 1 9	57/6	54/6
Hackbridge Cable	5/-	22/-		20	20	4 11 0	22/6	14/-
Hackbridge & Hewittic	5/-	33/9		25	30	4 9 0	33/9	23/9
Hall Tel. Acc.	10/-	21/-		10	10	4 15 3	22/6	11/-
Heatrae	2/-	5/9		12½	15	5 4 4	5/9	4/3
Henley's	10/-	21/3		10½	10½	4 18 9	21/3	17/-
Holophane...	5/-	18/9	+1/3	20	25	6 13 3	19/9	16/-

* After scrip issue. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

a scrip issue, and on the larger total the directors propose a dividend of 12½ per cent. This will represent a 2½ per cent increase on last year's payment, and will be covered more than five times by the latest earnings.

Telephone Manufacturing

Recent support for the 5s shares of Telephone Manufacturing recalls that, at the recent annual meeting, the chairman notified shareholders of official consent to a proposed one-for-five scrip issue. The necessary meeting is to be held at the end of September. He reported the maintenance during the past year of a high level of activity in all branches of the business. Trading profit, after tax, came out at £122,000, which compares with the previous figure of £149,000 and represents earnings of 28 per cent on the £750,000 ordinary capital. Dividends of 10 per cent have been paid for several years, and the company hopes to be able to maintain this rate after the scrip issue.

in Electrical Investments

Company or Board	Nom. Value	Middle Week's price 25th July	Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	50/-	−1/6	45	70	7 0 0	52/6	40/-
I.C.I.	£1	56/3		15	10*	3 11 0	61/9	38/3
Intl. Combustion	5/-	23/-		20	25	—	24/6	16/3
Johnson & Phillips	£1	43/9		15	15	6 17 3	52/6	43/9
Lancashire Dynamo	£1	56/3	+1/3	14	15	—	56/3	37/3
Laurence, Scott	5/-	19/6		20	12½*	3 4 0	19/6	14/6
Lister, R. A.	£1	39/-		12	9·3*	4 15 3	40/-	30/6
London Elec. Wire	£1	61/3		10	12½	4 1 9	61/3	50/6
Lucas, J.	£1	54/-	+4/6	10·8	7½*	2 15 6	56/6	41/6
Marryat & Scott	2/-	12/3		25	30	4 18 0	13/-	9/6
Mather & Platt	£1	75/-	+4/6	15	13·4*	3 11 6	75/-	48/-
Metal Industries	£1	35/-	−6d	12	9	5 2 9	38/-	30/-
Midland Elec. Mfg.	£1	53/9	−1/3	15	10*	3 14 6	55/-	44/-
Morphy-Richards	4/-	33/9		40	35*	4 3 0	35/-	27/-
Murex	£1	66/-		15	15	4 11 0	66/-	49/3
Newman Ind.	2/-	2/9		10	10	7 5 6	3/6	2/4
Oldham & Son	1/-	4/-		17½	20	5 0 0	4/-	2/10
Parnall (Yate)	5/-	10/6	−9d	8	14	6 13 3	13/2	7/3
Parsons, C. A.	£1	95/-	+2/6	7½	10	2 2 0	100/-	56/-
Plessey	10/-	87/6	+5/-	30	20*	2 5 9	89/-	57/6
Pye Deferred	5/-	43/9	+5/-	20	12½*	2 17 3*	47/6	28/6
Revo	10/-	15/-x.d.		27½	9*	6 0 0	15/6	12/6
Reyrolle	£1	125/-	+2/6	13½	15	2 8 0	127/6	89/-
Rheostatic	4/-	14/3		20	22½	—	14/3	9/3
Richardsons Westgarth	5/-	19/-	+1/-	15	15*	3 19 0	19/-	11/-
Scottish Cables	4/-	20/-		27½	27½	5 10 0	22/6	19/3
Smith (England), S.	4/-	20/-	+1/6	15	17½	3 10 0	20/-	15/-
Southern Areas	£1	38/-	+6d	7½	10	5 5 3	38/-	27/6
Strand Elec.	5/-	10/9	+6d	17½	17½	8 2 9	10/9	8/6
Sturtevant	5/-	35/6		18·9	14·4†*	2 0 9†	35/9	21/-
Sun. Elec.	£1	35/-x.d.		15	15	8 11 6	35/-	33/9
Switchgear & Cowans	5/-	17/-		10	20	5 17 9	17/-	11/-
Taylor Tunnicliff	5/-	16/3		12½	15	4 12 3	16/3	11/3
T.C.C.	10/-	51/3		30	25*	4 17 6	51/3	41/-
T.C. & M.	£1	35/6	+6d	8½	8½	4 15 9	40/9	35/-
Telephone Mfg.	5/-	11/6	+1/-	10	10	4 7 0	11/6	9/3
Thorn Elec.	5/-	25/9	−6d	20	15*	2 17 9	33/-	13/9
Thornycroft	£1	47/6	+2/6	15	15	—	47/6	34/6
Tube Investments	£1	105/-	+7/6	15	17½	3 6 9	107/6	72/6
Vactric	5/-	21/3		10	15*	3 10 7	22/-	12/-
Veritys	5/-	11/-	+6d	12½	12½	5 13 9	11/-	7/-
Walsall Conduits	4/-	67/6	+1/3	70	70	4 3 0	67/6	50/-
Ward & Goldstone	5/-	40/9	−6d	50	30*	3 13 6	45/-	37/6
Watford	2/-	8/9		22½	25	5 14 3	8/9	6/3
Westinghouse Brake	£1	108/9		16	18	3 6 3	110/-	82/-
West, Allen	5/-	16/3	−3d	17½	15*	4 12 3	16/6	8/-
Wolf Electric	5/-	21/-		17½	20	4 15 3	21/-	16/1
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A. Ord.	100	75½		6	6	7 19 0	88	75½
Ord.	100	50		3¾	3¾	7 17 6	54½	50/-
Anglo-Portuguese	£1	26/-		8	8	6 3 0	26/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	24/-	+6d	50	22½*	4 13 9	24/3	19/6
Cable & Wireless:								
Ord.	£1	54/-		9	10	3 14 0	54/-	39/6
4% Loan	100	94½		4	4	4 5 6	100	92
Calcutta Trams	£1	22/6		2½†	6†	5 6 8†	25/-	20/-
Cape Elec. Trams	£1	18/-		5½	7½	8 6 8	18/-	16/6
Marconi Marine	£1	41/3		10	10	4 17 0	41/3	33/-
Oriental Tel. Ord.	£1	83/9x.d.		16	16	—	102/6	96/6
Telephone Props.	£1	100/-	+1/3	—	20	4 0 0	100/-	80/6
Telephone Rentals	5/-	13/6		10	12½	4 12 6	13/6	9/6

New Issues

Dealings were expected to start yesterday (Thursday) at around 15s 6d. in the newly marketed shares of Colvern Holdings, Ltd. Particulars concerning the issue were published last Monday. Bowthorpe Holdings 5s shares, the subject of a public offer at 8s 9d per share in the previous week, eased off to 12s. Elliott Brothers new 5s shares, offered to shareholders at 20s, have been commanding a premium of around 28s, a figure drawing attention to the fact that applications may be made for "excess" shares. Premium on the new shares issued by Telegraph Construction & Maintenance at 32s 6d improved to 2s 9d, but lost 6d of the rise, while Enfield Rolling Mills new shares, now fully paid, rose to 80s (after 82s).

Dividends Declared

The addition of a 5 per cent bonus to the final dividend declared by Electrical Components, raising the total for the year from 20 to 25 per cent, was well received in the market. With net tax profits some 60 per cent higher than before, the distribution remains covered between three and four times over. Shareholders are advised of a coming "rights" issue of shares. Parmiter, Hope & Sugden 1s shares changed hands at around 3s following the maintenance of the dividend at a total of 30 per cent, and Globe Telegraph Trusts were called 12s 9d after the raising of the final dividend, making 10 per cent, on the strength of a further material expansion of revenue.

Gauge and Tool Design

The Gauge and Tool Makers' Association has decided to introduce a certificate of gauge and tool design and draughtsmanship, the object being to offer an incentive to young men anxious to become skilled gauge and tool draughtsmen and designers. The conditions under which this new certificate will be awarded are as follows:—The applicant shall have served a bona-fide apprenticeship, with due emphasis on the draughtsmanship aspect, with a firm which is a member of the Association; and he shall have obtained his higher national certificate in mechanical or production engineering, or other equivalent approved qualification.

REPORTS and DIVIDENDS

E. K. Cole, Ltd.—In the course of his speech at the annual meeting held on 19th July, Mr. E. K. Cole (chairman and managing director) said that trading conditions in the radio industry continued at a high level. An upswing experienced in the autumn, especially in television continued after the end of 1954, but more recently there had been a trend towards a seasonal decline in demand. Car radio equipment was supplied on an increasing scale. During the year a new factory building was completed which enabled television production to be considerably increased. Steps had been taken to ensure that when colour television became a practical proposition in this country, they would be ready to take full advantage of its commercial possibilities. The subsidiary, Egen Electric, Ltd., makers of specialized radio components, had had a successful year, and Ekco Electronics, Ltd., had made further progress in the development and sale of electronic equipment for commercial use and had expanded its turnover in the field of nucleonic measurement at home and abroad. The demand for their plastics products had been such that even the increased plant had been unable to fulfil all the calls made upon it. The heating division increased its turnover substantially and plans had been made to provide a further increase in turnover during the forthcoming year. New products had been added to their range and had been well received. Although they were able to maintain their volume of exports, in order to compete, the margins on certain of the products marketed overseas had to be very fine.

Electrical Components, Ltd.—The group trading profit for the year to 31st March last is £212,784, as compared with £138,907 for 1953-54. Taxation absorbs £110,697, and it is proposed to pay a final dividend of 12½ per cent (same) together with a bonus of 5 per cent, making 25 per cent for the year (against 20 per cent). The balance of £75,340 is retained as reserves, etc.

The directors intend to apply to the Capital Issues Committee for permission to offer 234,908 additional ordinary shares to existing shareholders on the basis of one for three.

Pye, Ltd.—A preliminary statement covering the year ended 31st March last shows group profits, before taxation, of £2,199,302, as compared with £1,127,886 for the preceding year. After providing £1,161,677 for taxation, the net balance is £1,023,560 (against £259,690). Subject to the consent of the Capital Issues Committee, it is proposed to make a one-for-one free issue of deferred ordinary capital and to pay a dividend of 12½ per cent on the consequent doubled capital. The dividend is equivalent to 25 per cent on the capital existing before the issue, which has already been increased by two "rights" issues aggregating 1,218,446 5s "A" deferred ordinary shares during the year. The dividend for the previous year on the smaller capital was 20 per cent. As in the previous year holders of 8 per cent cumulative participating preferred ordinary receive a 2 per cent participating dividend for the maximum of 10 per cent.

Vent-Axia, Ltd.—The annual general meeting was held on 19th July, Mr. J. C. Akester (chairman and managing director) presiding. In his circulated statement, the chairman said that during the year under review the demand had shown a steady upward trend, both at home and abroad. The subsidiary, Axia Fans, Ltd., which manufactured and installed ventilating and heating systems for the shipping industry, had progressed satisfactorily; the turnover reached a new high level, and the orders in hand and those anticipated would keep the works busy for at least the next two years.

Associated British Engineering, Ltd.—The group trading profit for the year to 31st March last is £305,524 which, with other income, makes a total of £329,295, as compared with £268,188 for 1953-54. After meeting all charges, including £159,732 for taxation, the net profit (after adjustments) is £148,556 (against £171,160). General reserve receives £75,000 and it is proposed to pay a final ordinary dividend of 6 per cent (5 per cent), making 10 per cent for the year (8 per cent). The balance carried forward is £48,998 (against £48,789 brought in).

The Cables Investment Trust, Ltd.—The net profit for the year to 30th June last is £294,963, as compared with £229,228 for the previous year. It is proposed to pay a final dividend of 7 per cent, making 10 per cent for the year on £2,550,000 ordinary stock. For the previous year the total distribution was 9 per cent, of which the final dividend of 6 per cent was paid on capital increased to £2,050,000 by a scrip issue. The capital was raised to its present figure by a "rights" issue of £500,000 in August last.

The Oriental Telephone & Electric Co., Ltd., announces that, as the accounts from Singapore for the past year have been received later than usual, due to pressure of work connected with the take-over of the company's undertakings, the board has declared a second interim dividend for the year 1954 at the rate of 2s 4·8d per stock unit, which is equivalent to 12 per cent on the issued ordinary stock before the recent capital repayment. It is not expected that the annual general meeting will be held until September. When the accounts for 1954 are completed the board will consider the recommendation of a final dividend for that year.

Parmiter, Hope & Sugden, Ltd., report that after deducting £30,085 for taxation the net profit for the year to 31st March last is £19,410, as compared with £31,578 for the preceding year. The dividend for the year is maintained at 30 per cent by a final payment of 22½ per cent. The balance carried forward is £21,474 (against £27,300 brought in).

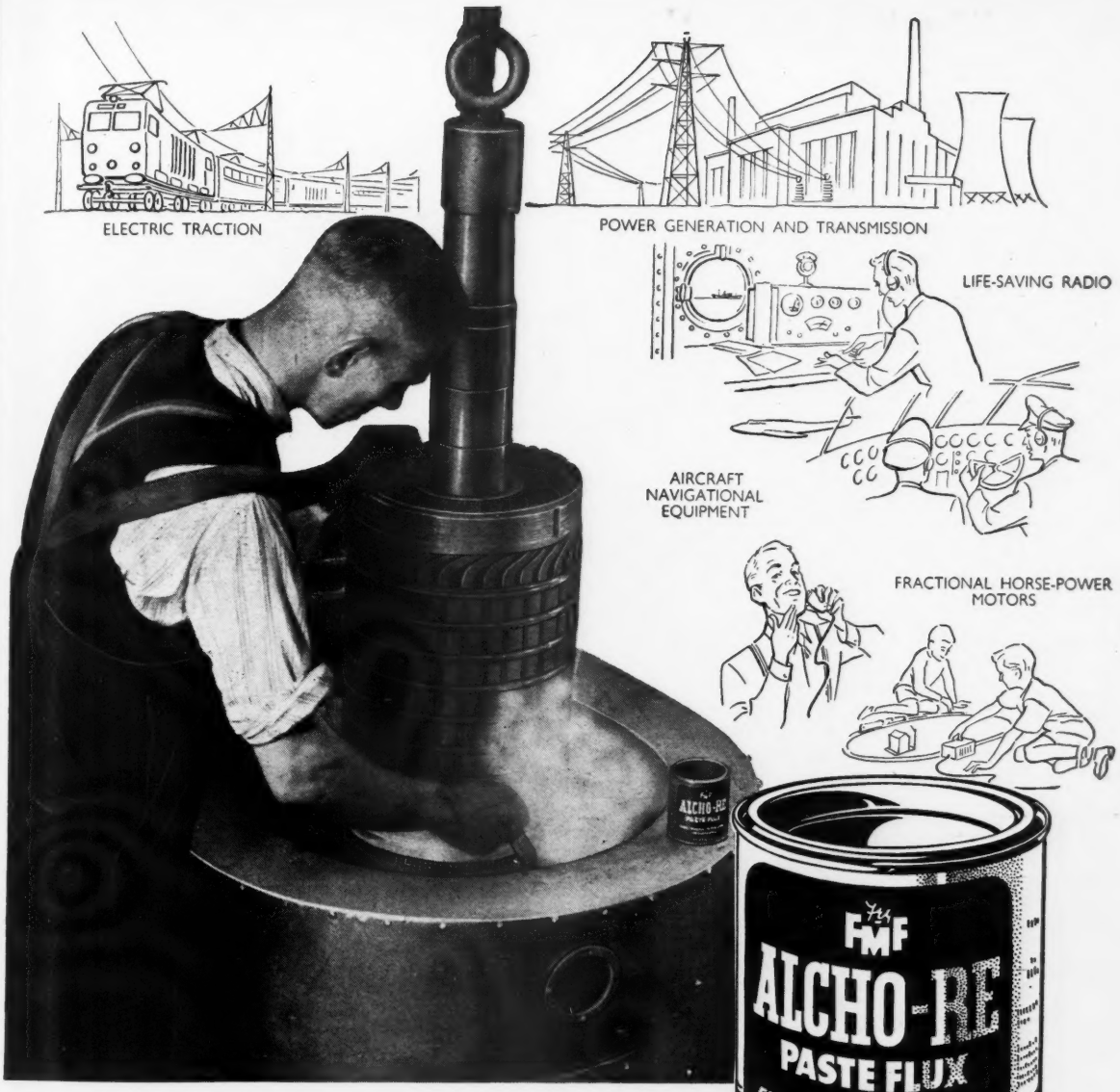
The Pirelli-General Cable Works, Ltd.—The net profit for the year ended 31st March last is £1,162,502, as compared with £1,274,147 for the previous year. The profit is struck before taxation of £520,007. General reserve receives £300,000 and stock depreciation reserve £200,000. It is proposed to pay a dividend of 10 per cent on capital doubled by £1,000,000 capitalization of reserves. This compares with a dividend of 8 per cent and a bonus of 12 per cent for 1953-54. Half the equity is held by the General Electric Co., Ltd.

The Globe Telegraph & Trust Co., Ltd.—The preliminary statement for the year ended 30th June last shows net earnings of £353,499, as compared with £275,370 for 1953-54. Taxation absorbed £271,927. General reserve receives £50,000. It is proposed to pay a final dividend of 7 per cent on capital increased by the issue of 1,117,799 ordinary £1 shares. An interim dividend of 3 per cent was paid on the former capital.

Efco, Ltd. (formerly the Electric Furnace Co., Ltd.).—The provisional figures for the year to 31st March last show profits, before taxation, of £258,000. Taxation requires £129,000, leaving a balance of £129,000. It is proposed to pay a final ordinary dividend of 10¼ per cent on capital doubled by a scrip issue (against 6½ per cent on the old capital). An interim dividend of 4½ per cent (3½ per cent) was paid before the scrip issue.

Reliance-Clifton Cables & Industrial Products, Ltd.—The annual general meeting was held on 22nd July. Sir Robert Renwick, Bt. (chairman), who presided, said that until late in the year trading conditions were exceedingly difficult. The sharp fall in demand brought in its wake intensive competition and short uneconomic production runs were all too frequent. Violent fluctuations in the price of copper added to the difficulties. In the last few months substantial orders were placed by the Post Office. There was also a marked improvement in other directions, but it was too late in the year to have much effect on trading results. The order book at the moment was satisfactory. As regards telecommunication wires and cables, in which they specialized, Post Office demands had continued at a high level

[*Continued on page 237*



'ENGLISH ELECTRIC', the world-famous manufacturers, use FRY's Alcho-Re flux in many soldering processes. The above picture (reproduced by kind permission of The English Electric Company Limited) shows the flood-soldering of armature coil leads to the commutator of a DC traction motor. Throughout this process Alcho-Re flux is used for all soldering

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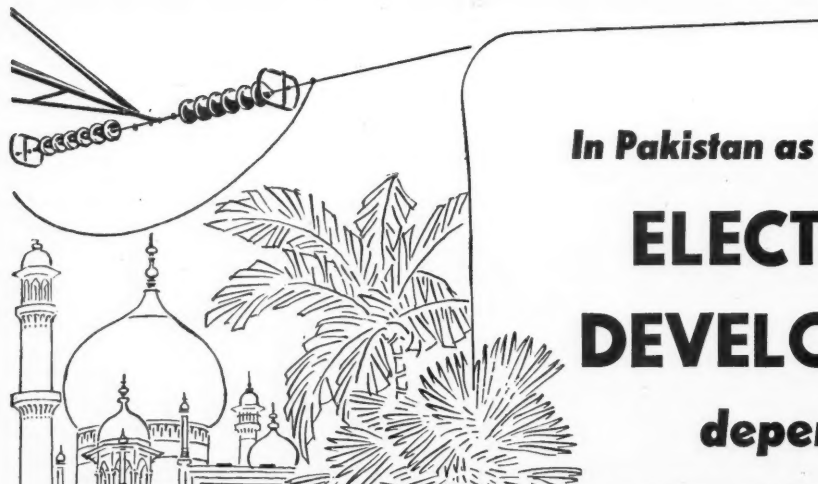

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In Pakistan, where electrification is proceeding apace, Tudor Battery equipment is making its contribution. One of the latest Tudor export shipments comprises a 230 volt battery and combined rectifier charger/D.C. switchboard supplied through Ferguson Pailin, Ltd. for E.H.T. switchgear operating, indication and emergency duties in Dargai Power Station, North West Frontier Province.

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(*Continued from page* 236)

and they had been particularly successful in their tendering. Useful orders had been received from the Admiralty and the United Kingdom Atomic Energy Authority for special products developed in earlier years. The improvement in the general level of demand had been maintained.

Despite this welcome change in the situation, the stable conditions which the industry had enjoyed until recent years have not yet been restored. Profit margins which tapered during 1953 and suffered a further decline in 1954 had in their field shown no general signs of improvement. It could be inferred that despite the improvement in trade, the rate of current demand would be broadly not much more than balancing productive capacity. The full-scale development of the telephone service was, however, yet to come. At the moment progress was dependent on the rate at which exchange buildings could be constructed, and it would thus be some years before the full resources of the industry in the production of exchange equipment, telephones and cables could be deployed. In the meantime, slender profit rates must be countered by a constant search for improvements in manufacturing methods and consequent reductions in costs. The board was considering whether some employees might wish to be given facilities to invest in the company's shares. If this should be the case, he thought that stockholders would not be averse to the issue of a small amount of ordinary capital to be made available at about market price.

Phœnix Telephone & Electric Holdings reports group profits for the year ended 28th February last of £54,482, as compared with £54,483 for the previous year. General reserve receives £27,500, and the dividend for the year is maintained at 15 per cent. The balance carried forward is £20,082 (against £19,907 brought in).

Murex, Ltd.—The group profit for the year to 30th April last is £1,025,000, as compared with £657,000 for 1953-54, and after deducting taxation of £515,000 the net balance is £510,000 (against £267,000). It is proposed to pay a final ordinary dividend of 9 per cent, and a cash bonus of 5 per cent, making 20 per cent for the year (against 15 per cent). The directors state that this extra distribution should not be taken as a permanent feature. Earlier this month a sum of £220,000 was distributed from capital profits on the sale of the holding in Hard Metals, South Africa. The balance carried forward is £170,000 (against £134,000 brought in).

Aiton & Co., Ltd.—In the course of his speech at the annual meeting held on 22nd July, Wing-Commander J. M. Aiton (chairman and managing director) said that during the current year they had brought into use an extension to the foundry and within the next few months they hoped to finish alterations to the evaporator section. More plant was being installed at Derby and Southwick. Prospects for the future were good. The evaporator division had had a successful year, and the pipework division continued to be well employed. Sales of "Uniload" constant load supports were increasing, and in addition to power stations, they were being used and were on order for several oil refineries, both in this country and overseas.

Thorn Electrical Industries, Ltd., announces in connection with the recent "rights" issue of 2,137,500 "A" ordinary shares of 5s each at 17s 6d per share that more than 99 per cent have been taken up.

Mather & Platt, Ltd., have declared an interim dividend of 4 per cent (unchanged).

Colvern Holdings, Ltd., has applied to the Council of the London Stock Exchange for permission to deal in and for quotations for its £175,000 5¼ per cent debenture stock and £175,000 of ordinary shares.

New Companies

E. A. Stevenson (Electrical), Ltd.—Registered 5th July. Capital £5,000. Dealers in and hirers and repairers of radio and television instruments, washing machines, vacuum cleaners, etc. Directors: E. A. Stevenson and Mrs. Phyllis B. Stevenson. Regd. office: 178, Oakfield Road, Liverpool, 5.

Leland Components Co., Ltd.—Registered 1st July. Capital £15,000. To invest, design and develop equipment connected with industrial, agricultural, commercial or research work with special emphasis on the engineering sections of these activities, and particularly in the electrical, electronic or nucleonic aspects of these fields of work, etc. The first directors are to be appointed by the subscribers. Solicitors: Fitzhugh Woolley & Co., Brighton.

Leland Leroux, Ltd.—Registered 1st July. Capital £15,000. Directors: Lt. Rex I. Cowley, W. H. Cowley and Capt. Philip F. Glover, R.N. Objects and other particulars are similar to Leland Components Co., Ltd.

E.O. & P.J.F.A., Ltd.—Registered 2nd July. Capital £1,000. Electricians, electrical and electronic engineers, etc. Directors: E. Osborn and P. J. F. Andrews. Regd. office: 130, Kirkdale, S.E.26.

Electrical Process Controls, Ltd.—Registered 7th July. Capital £100. Manufacturers and sellers of electrical and other heaters, electric fires, irons, fans, cookers, etc. Directors: G. Smith and G. A. Fox. Regd. office: 10, Park Square, Leeds.

G. & F. Allitt, Ltd.—Registered 17th June. Capital £15,000. Electrical and electronic engineers and contractors, manufacturers of and dealers in dynamos, motors and motor control gear, armatures, magnetos, etc. Directors: G. Allitt and F. Allitt (secretary). Regd. office: Marine Garage, Marine Road, Prestatyn, Flints.

L. J. Evis & Sons, Ltd.—Registered 7th July. Capital £1,000. Electrical, mechanical and general engineers and contractors, etc. Directors: R. Evis, B. C. Evis, R. J. Evis and J. Evis. Regd. office: 33, West Street, Bridgwater, Som.

Smith & Baxter, Ltd.—Registered 6th July. Capital £1,000. Manufacturers, wholesalers and retailers of electrical components, including radio and television sets, etc. The first directors are not named. Solicitors: Toller, Pochin & Wright, Leicester.

Herbert Hartley (Electrical), Ltd.—Registered 11th July. Capital £5,000. Electrical, constructional, radio, television, electronic, mechanical and general engineers, etc. Directors: H. Hartley and Mrs. Ivy E. Hartley. Regd. office: 45-47, Market Street, Colne.

Liquidations

Power Application, Ltd., electrical and mechanical engineers.—Last day for receiving proofs for dividend 3rd August. Mr. F. M. Collins, Official Receiver and Liquidator, Inveresk House, 346, Strand, London, W.C.2.

Lupton & Hopkinson, Ltd., radio and electrical engineers.—Winding up voluntarily. Liquidator, Mr. A. W. Ashworth, 69, Otley Road, Shipley, Yorks, appointed 11th July.

Electrical & Radio Engineers (Golders Green), Ltd.—Last day for receiving proofs for dividend to preferential creditors 30th July. Mr. J. M. Clarke, senior official receiver and liquidator, Inveresk House, 346, Strand, London, W.C.2.

Electronics (Leeds), Ltd.—Winding up voluntarily. Liquidator, Mr. M. T. Kendrick, Norwich Union Building, City Square, Leeds, appointed 7th July.

Bankruptcies

S. R. Nightingale, 149, Elm Bank Terrace, South Street, Andover, Hants, electrical engineer and poultry farmer, lately carrying on business at St. Swithin's, Waltham Chase, Southampton.—First meeting to-day (Friday) at the Official Receiver's office, 16, Westwood Road, Southampton. Public examination 28th September at the County Court, The Castle, Winchester.

R. B. Goetze, residing at 5, North End, Wisbech, Cambs, electrician, lately carrying on business at the Old Market, Wisbech, as an electrical contractor.—Trustee, Mr. C. A. Taylor, 41, Sidney Street, Cambridge, Official Receiver, released 11th July.

E. B. Page, 10 and 12, John Street, Hyde, Ches, electrical engineer.—Supplemental dividend of 10s 3¾d in the £ (making 20s in the £), payable at the Official Receiver's office, 20, Byrom Street, Manchester, 3.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 31st August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

18203. Sylvania Electric Products, Inc.—Electroluminescent lamp. 20th July, 1950. (735752.)

25698. Cox, F. B.—Electromagnetic operating or control devices. 22nd October, 1951. (736071.)

29499. British Insulated Callender's Cables, Ltd.—Arrangements for carrying out continuous processes on long rigid articles. 30th November, 1951. (735931.)

1951

20382. Sperry Gyroscope Co., Ltd.—Potentiometers and variable resistors. 9th October, 1952. (735856.)

22824. British Thomson-Houston Co., Ltd.—Glass compositions. 30th September, 1952. (736073.)

1952

2845. Murphy Radio, Ltd.—Electronic time base circuits. 2nd February, 1953. (736005.)

3933. Automatic Coil Winder & Electrical Equipment Co., Ltd.—Valve testers. 3rd February, 1953. (735865.)

5671. Industrial Distributors (1946), Ltd.—Electrostatic separation processes and apparatus. 4th March, 1952. (735870.)

6897. Calor-Emag Elektrizitats Akt.-Ges.—Electric switches incorporating means for dousing, with extinguishing fluid, arcs arising on separation of the switch contacts. 17th March, 1952. (735934.)

7765. British Thomson-Houston Co., Ltd.—Protection of electrical circuits. 5th March, 1953. (735755.)

11641. International Business Machines Corporation.—Gaseous electric discharge tubes and circuit arrangements therefor. 8th May, 1952. (736078.)

12716. Westinghouse Electric International Co.—Electric circuit-breakers. 20th May, 1952. (736090.)

15111. Simmonds & Stokes (Niphan), Ltd.—Electric cable couplings. 10th June, 1953. (735937.)

15243. Schwarz, B.—Control systems for electric motors. 16th June, 1953. (735938.)

17449. British Telecommunications Research, Ltd.—Harmonic generators. 8th July, 1953. (735940.)

18363. Mullard Radio Valve Co., Ltd.—Cold-cathode gas discharge tubes. 8th July, 1953. (735878.)

18386. Metropolitan-Vickers Electrical Co., Ltd.—Saturable core reactance devices. 23rd April, 1953. (736016.)

18820. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 1st June, 1953. (735941.)

19043. Soc. d'Electronique et d'Automatisme.—Electrical calculators. 28th July, 1952. (736085.)

19809. British Insulated Callender's Cables, Ltd.—Method and means for the production of tubes or tubular coverings. 5th August, 1953. (736018.)

20186. Metropolitan-Vickers Electrical Co., Ltd.—Electrical protective equipment. 11th August, 1953. (736087.)

20255. Reyrolle & Co., Ltd., A.—Gas-blast circuit-breakers. 12th November, 1953. (736088.)

20375. Metropolitan-Vickers Electrical Co., Ltd.—Crack-detecting apparatus. 24th July, 1953. (735880.)

20376. Metropolitan-Vickers Electrical Co., Ltd.—Indicating devices for electric and magnetic circuits. 23rd June, 1953. (735881.)

21635. Cinema-Television, Ltd.—Electrical counting apparatus. 28th August, 1953. (735942.)

22089. Tuchel, U.—Two-part couplings or connectors for electric cables. 2nd September, 1952. (736091.)

24879. General Electric Co., Ltd., and Taylor, S.—Arc control devices for liquid-blast circuit-breakers. 5th October, 1953. (735884.)

27473. General Electric Co., Ltd., and Howarth, P.—Electric thermostats. 2nd November, 1953. (736096.)

27931. Planer, G. V.—Electrical resistors. 29th January, 1954. (735889.)

29529. Compagnie Générale de Télégraphie sans Fil.—Radar systems. 21st November, 1952. (735769.)

31128. Electric & Musical Industries, Ltd.—Electronic tubes. 8th December, 1953. (735944.)

32241. Philips Electrical Industries, Ltd.—Anisotropic permanent magnets. 19th December, 1952. (736105.)

32575. Automatic Telephone & Electric Co., Ltd.—Mounting arrangements for gas discharge tubes. 9th October, 1953. (735775.)

1953

2867. Lucas (Industries), Ltd., J.—Foot operable electric switches. 28th January, 1954. (736113.)

3172. Sternat, F.—Flat electric pocket lamp. 4th February, 1953. (736114.)

3477. Marconi's Wireless Telegraph Co., Ltd.—Hybrid junction arrangements for use on micro radio waves. 22nd January, 1954. (735901.)

4099. Mullard Radio Valve Co., Ltd.—Photo-electric cells. 12th February, 1954. (735903.)

4232. Crossley Bros., Ltd., and Carter, H. D.—Exhaust gas driven turbines. 10th December, 1953. (736116.)

4430. British Dielectric Research, Ltd.—Ceramic dielectric materials. 16th February, 1954. (736117.)

4804. General Electric Co., Ltd., and Jacoby, H. C. E.—Coil winding machines. 22nd March, 1954. (735951.)

6729. Glover & Co., Ltd., W. T.—Electric resistance element. 10th March, 1954. (735786.)

7059. Siemens Electric Lamps & Supplies, Ltd.—Electric protective cut-out arrangements. 5th March, 1954. (735908.)

8386. Allis-Chalmers Manufacturing Co.—Electric circuit interrupter. 26th March, 1953. (735955.)

9124. Egan Electric, Ltd., and Levi, J. E.—Variable electric resistors. 2nd April, 1954. (736044.)

9724. Ashley Accessories, Ltd.—Electric ceiling roses. 26th February, 1954. (736125.)

9727. Electric & Musical Industries, Ltd.—Monitoring of electric signal distributing systems. 2nd April, 1954. (736126.)

9762. Wayne Kerr Laboratories, Ltd., and Calvert, R.—Alternating current bridges. 2nd April, 1954. (735915.) 9870. Electrical bridges employing transformer ratio arms. 2nd April, 1954. (735916.) 9972. Alternating current bridges for measuring impedances. 2nd April, 1954. (735917.)

10060. Soc. des Accumulateurs Fixés et de Traction.—Negative electrodes for alkaline storage batteries. 13th April, 1953. (735793.)

12003. British Insulated Callender's Cables, Ltd.—Insulated electric cables and impregnating compounds therefor. 29th April, 1954. (735960.)

12044. Philips Electrical Industries, Ltd.—Floodlights. 4th January, 1954. (735961.)

15007. British Thomson-Houston Co., Ltd.—Methods of dynamic balancing and apparatus therefor. 5th May, 1954. (735802.) 15008. Dynamic balancing apparatus and methods. 6th May, 1954. (735803.)

16019. S.A.S. Lavorazione Materie Plastiche (L.M.P.) di M. I. Colombo & C.—Extrusion head for providing cables with multi-layer coating. 10th June, 1953. (736053.)

16718. General Electric Co.—Silicone rubber. 17th June, 1953. (735807.)

17430. General Electric Co., Ltd., and Small, G. F.—Electric amplifier arrangements. 18th June, 1954. (735927.)

21723. International Business Machines Corporation.—Electronic reading systems for punched tapes or cards. 6th August, 1953. (735821.)

23449. British Thomson-Houston Co., Ltd.—Insulation of end windings of the stator of a dynamo-electric machine. 25th August, 1954. (735826.)

23812. Standard Telephones & Cables, Ltd.—Dry contact rectifiers. 28th August, 1953. (735980.)

25653. Télémecanique Electrique.—Insulated terminals for electrical connections. 16th September, 1953. (735985.)

26233. Radio Corporation of America.—Method of making p-n junction devices. 23rd September, 1953. (735986.)

26718. Western Electric Co., Inc.—High frequency magnetic cores. 29th September, 1953. (735989.)

28663. Queunie, L. C.—Stereoscopic television apparatus. 16th October, 1953. (735993.)

29061. Philips Electrical Industries, Ltd.—Manufacture of electric resistors. 21st October, 1953. (735999.)

29370. Radio Corporation of America.—Transistor amplifier. 23rd October, 1953. (736063.)

31118. Philips Electrical Industries, Ltd.—Contact members for electric discharge tubes. 10th November, 1953. (735841.)

31554. General Electric Co.—Cathode-ray tubes. 13th November, 1953. (736139.)

33409. Stability Radio Components, Ltd.—Electric capacitors. 1st December, 1953. (735844.)

34062. Radiation Research Corporation.—Treatment of electrically insulating materials subjected to ionizing radiation and apparatus for measuring such radiation. 8th December, 1953. (735847.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 6th August:—

DYNO-MITE (design). No. 739,981, Class 7. Electrically driven tools, tools for use in electrically operated tools and parts.—Millers Falls Co., Greenfield, Mass, U.S.A. Address for service, c/o Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

REPORTER. No. 736,930, Class 9. Radio, television, telecommunication, telegraphic and telephonic apparatus.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

ALEMITE. No. 738,950, Class 9. Electronic apparatus and instruments for use in locating and indicating the area and extent of unbalance in wheels.—Stewart-Warner Corporation, Chicago, U.S.A. Address for service, c/o Stevens, Langer, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

MR. CONTROLS (design). No. 740,326, Class 9. Thermostats, thermostatic valves, thermostatic switches, thermostatic pilot controls for preventing the escape of unburned gas from fluid fuel burners, electromagnets, thermocouples, corrugated bellows and diaphragms, all being parts of scientific or electrical apparatus and parts.—Robertshaw-Fulton Controls Co., Greensburg, Penn., U.S.A. Address for service, c/o Mewburn Ellis & Co., 70, Chancery Lane, London, W.C.2.

Swiss Electrical Trade

Substantial Rise in Imports

In its aggregate value, Switzerland's export trade in electrical goods last year did not vary greatly from 1953, but in the group totals some changes occurred. For example there were increases in the value of exports of power plant (about 12 per cent), the telegraph and telephone group (doubled, with a large quantity for Venezuela), and meters and measuring instruments. Thus in all three of these lines the decline in 1953 was offset. In a number of Latin American markets Swiss dynamo-electric machinery made notable headway. The only outstanding decline was in radio apparatus. The accompanying table shows the values of the principal classes of equipment exported to some of the leading destinations last year, together with notes of increases and decreases on 1953. (Average rate, Sw. fr. 12·22=£1.)

The electrical import trade last year showed an increase in value of roughly 30 per cent. All the leading groups except dynamo-electric machines and some heavy unspecified apparatus shared in the rise. In radio goods it was substantial. This is the only branch of the electrical trade in which Switzerland imports more than she exports. The accompanying table gives the values in 1954 of the main groups with the principal supplying countries and notes of increases or decreases on the previous year. It will be seen that Germany's share increased throughout every range with the sole exception of cables.

EXPORTS

Class of Equipment	1954 Sw. fr. (000)	Inc. or dec. on 1953 Sw. fr. (000)
Accumulators	3,617	− 604
To Germany	441	− 91
,, France	243	− 114
,, Belgo-Luxemburg	556	+ 262
,, Netherlands	278	− 13
Insulators	3,430	− 370
To Belgo-Luxemburg	337	− 78
,, Netherlands	425	− 109
,, Germany	362	+ 22
,, Sweden	367	+ 209
,, Italy	271	− 249
Meters and measuring instruments	28,933	+ 1,410
To France	3,431	+ 866
,, Italy	3,197	− 473
,, Netherlands	2,470	+ 266
,, Belgo-Luxemburg	2,266	− 156
,, Germany	1,871	+ 295
,, Sweden	1,717	− 40
,, Norway	1,408	− 57
,, Denmark	1,058	+ 214
Dynamo-electric machines	124,535	+ 14,614
To Spain	8,123	− 2,273
,, Brazil	7,504	+ 1,008
,, Belgo-Luxemburg	7,450	+ 2,763
,, Denmark	6,994	+ 4,091
,, Netherlands	6,091	+ 867
,, France	6,003	− 4,954
,, Norway	5,992	+ 2,776
,, Mexico	5,433	+ 1,709
,, Colombia	5,308	+ 2,738
,, Portugal	5,542	+ 3,096
,, Germany	5,138	+ 1,139
,, U.S.A.	4,739	+ 1,366
,, Austria	4,421	+ 2,482
,, Sweden	3,887	− 192
,, India	3,667	+ 194
Lighting and starting equipment for vehicles	5,414	− 138
To Netherlands	1,241	+ 230
,, France	794	− 290
,, Italy	697	− 98
,, Germany	695	+ 338
,, U.K.	300	+ 1
Telegraph and telephone apparatus	15,346	+ 7,579
To Netherlands	4,783	+ 1,354
,, Venezuela	4,111	+ 3,949
,, Israel	949	+ 653
,, Germany	815	+ 219
,, Italy	697	+ 187
Radio apparatus	12,544	− 5,691
To Colombia	1,568	+ 580
,, France	1,055	+ 47
,, Belgo-Luxemburg	1,017	+ 376
,, Germany	804	− 923
,, Italy	971	− 4,436
,, Netherlands	652	− 258
,, Finland	617	− 106
Unspecified electrical apparatus over 500 kg.	37,524	+ 2,898
To U.S.A.	6,024	+ 4,042
,, Brazil	2,955	+ 1,652
,, Sweden	2,461	− 1,620
,, Belgo-Luxemburg	2,082	+ 1,152
,, Germany	2,010	+ 759
,, Canada	1,892	− 185
,, Portugal	1,533	+ 909
,, Spain	1,552	+ 939
,, Austria	1,433	+ 1,070
,, Colombia	1,732	+ 1,415
,, Uruguay	1,390	+ 1,327
,, Norway	1,267	+ 168
Ditto, 50–500 kg.	22,757	− 852
To Germany	1,665	+ 722
,, France	1,652	+ 363
,, Belgo-Luxemburg	1,550	+ 345
,, Netherlands	1,165	− 107
,, Spain	1,204	+ 332
,, Portugal	1,233	+ 616
,, Finland	1,023	− 377
,, Sweden	984	− 457
Ditto, 3–50 kg.	27,061	+ 1,571
To Germany	3,151	+ 1,098
,, Austria	1,156	− 81
,, France	2,876	+ 374
,, Italy	1,278	− 502
,, Belgo-Luxemburg	2,089	+ 229
,, Netherlands	2,718	+ 238
,, Spain	909	+ 22
,, Brazil	896	− 543
,, Canada	847	+ 499
Ditto, under 3 kg.	21,884	+ 3,394
To Germany	1,610	+ 414
,, France	3,996	+ 1,267
,, Belgo-Luxemburg	2,463	+ 246
,, Netherlands	2,533	− 62
,, Sweden	1,463	+ 94
,, Italy	1,154	+ 129
,, Australia	807	+ 715
Cables	4,215	+ 310

IMPORTS

Class of Equipment	1954 Sw. fr. (000)	Inc. or dec. on 1953 Sw. fr. (000)
Accumulators	2,444	+ 441
From Germany	1,057	+ 339
,, U.S.A.	449	− 51
Insulators	1,133	− 102
From Denmark	463	− 354
,, Germany	253	+ 171
,, France	230	− 38
Meters and measuring instruments	6,802	+ 834
From Germany	2,556	+ 407
,, U.K.	1,044	+ 329
,, U.S.A.	1,899	− 62
Telephone and telegraph apparatus	4,848	+ 1,042
From Germany	1,887	+ 322
,, Belgo-Luxemburg	2,789	+ 909
Radio apparatus	53,111	+ 21,834
From Germany	22,864	+ 6,741
,, France	15,172	+ 12,180
,, Netherlands	4,892	+ 1,746
,, U.K.	3,500	+ 764
,, U.S.A.	4,744	+ 72
Dynamo-electric machines	16,958	− 822
From Germany	9,164	+ 159
,, U.S.A.	2,154	− 89
,, Italy	1,400	− 271
,, France	1,160	− 1,000
,, U.K.	1,140	− 205
Lighting and starting equipment for vehicles	6,309	+ 886
From Germany	2,473	+ 452
,, U.K.	886	+ 223
,, U.S.A.	1,816	+ 151
Electric incandescent lamps	5,797	+ 857
From Germany	1,223	+ 421
,, Netherlands	2,303	+ 77
,, U.S.A.	1,150	+ 110
Cables	2,928	+ 242
From Germany	1,175	− 455
Unspecified elec. apparatus over 500 kg.	894	− 731
From Germany	556	*
Ditto 50–500 kg.	1,814	+ 227
From Germany	1,014	+ 165
Ditto 3–50 kg.	1,709	+ 191
From Germany	721	+ 42
,, France	274	+ 55
,, U.K.	173	− 2
Ditto under 3 kg.	6,224	+ 1,036
From Germany	3,555	+ 960
,, U.S.A.	962	+ 110

* Comparative figures not available.

STREET LIGHTING NOTES

A scheme for the conversion of street lighting from gas to electricity over a period of thirteen years at a total estimated cost of £1,300,000 is recommended by the BIRMINGHAM Public Works Committee.

In his annual report, Mr. T. Wilkie, city lighting engineer of LEICESTER, says that to replace all gas street lamps—numbering 3,772 at 31st December last—by electric lamps would cost well over £100,000. Complaints received of ineffective lighting almost without exception refer to streets lit by gas. "The Committee is well aware of the position and has frequently reiterated its intention to change over to electricity. The only difficulty is one of finance," says Mr. Wilkie. A modest start is to be made before next winter, but the conversion will take many years to complete.

A £16,500 plan for the lighting of Great Chertsey Road is being submitted to the Minister of Housing and Local Government by BRENTFORD and CHISWICK Borough Council. The scheme provides for the replacement of the existing gas lighting between Chiswick Bridge and Chiswick High Road by 140 W sodium vapour lamps mounted on concrete columns.

A £32,000 scheme providing for the re-lighting of about ten miles of side streets with 494 2/40 W fluorescent tubes on concrete columns at a mounting height of 15ft is being recommended to WOOLWICH Borough Council. A report of the Works Committee says the streets have been chosen according to the quality of the lighting, the age of the installation and the extent of the traffic.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Antrim.—11th August. Northern Ireland Hospitals Authority. Electrical installation in connection with alterations and additions to Massereene Hospital. F. D. Brown & Sons, consulting engineers, 93, Ann Street, Belfast.

Australia.—16th September. Brisbane City Council Electricity Department. Centralized load control equipment. (E.S.B. 15170/55. Ten/14702.)* 30th September. 33 kV metalclad switchgear for Tennyson power station. (E.S.B. 15169/55. Ten/14701.)*

26th September. New South Wales Electricity Commission. Seven 33 kV transformers for Yass substation. (E.S.B. 15018/55. Ten/14710.)*

Belfast.—9th September. City Council. 33 kV switchgear equipments and five 33/6·6 kV, 12,500 kVA outdoor stepdown transformers. Merz & McLellan, consulting engineers, Carliol House, Newcastle-upon-Tyne.

Canada.—8th August. Winnipeg Electric Company. Two 5,000 kVA transformers and metalclad switchgear for two unit substations in Greater Winnipeg area. (E.S.B. 15076-7. Ten/14676-7.)*

Castlewellen (Co. Down).—8th August. Northern Ireland Housing Trust. Electrical installations in 34 dwellings. Offices of the Trust, 12, Hope Street, Belfast.

Formosa.—11th August. Central Trust of China, U.S. Aid Division, Taipei. Welding equipment including one automatic welding machine, arc welders, cable connectors and electrode holders. (E.S.B. 14867/55. Ten/14631.)* 12th August. Cables, test meters, armature winding and servicing equipment. (E.S.B. 14868/55. Ten/14656.)*

India.—3rd August. Government of Madras Electricity Department. Lightning arrestors. (E.S.B. 15147/55. Ten/14666.)*

4th August. India Supply Mission, Washington. 26 electric oven furnaces for heat treatment of metals. (E.S.B. 15295/55. Ten/14728.)*

5th August. Damodar Valley Corporation, Calcutta. 660 V multi-core control cables, power cables and cable jointing boxes for grid substations. (E.S.B. 15197/55. Ten/14682.)*

18th August. Eastern Railway (Calcutta Electrification Project). 33 kV switchgear and switching station. (E.S.B. 15312/55. Ten/14700.)*

Iraq.—17th September. Directorate General of Municipalities, Baghdad. Two 150 kW and one 75 kW diesel alternator sets and 150 kW alternator, switchgear, heat exchangers, etc., for Samarrah. (E.S.B. 14790/55. Ten/14612.)* 15th October. Electric poles, pylons and line materials. (E.S.B. 15221/55. Ten/14720.)*

Midlothian.—19th August. County Council. Street lighting equipment. (See this issue.)

New Zealand.—12th August. Auckland Electric Power Board. V.i.r. triple braided cables. (E.S.B. 15128/55. Ten/14668.)* Weatherproof braided aerial. (E.S.B. 15191/55. Ten/14670.)* 26th August. 6,600 V paper insulated cable. (E.S.B. 15200/55. Ten/14680.)*

15th September. Post and Telegraph Department. Radio valves. (E.S.B. 15177/55. Ten/14678.)*

20th September. G.P.O. Adhesive electrical insulation tape. (E.S.B. 15179/55. Ten/14684.)*

Pakistan.—16th August. Posts and Telegraphs Department. Twenty-four one-ton self-contained air conditioning units for new transmitting station, Karachi. (E.S.B. 15149/55. Ten/14664.)*

Peterborough.—6th August. City Council. Electrical installations in 64 houses and 8 flats on the Walton estate. (See this issue.)

South Africa.—12th August. South African Railways, Stores Department. 2,000 primary cells for signalling. (E.S.B. 14996/55. Ten/14645.)* 250 magnetic wall type telephones. (E.S.B. 14998/55. Ten/14654.)* 30th September. Eight battery operated fork lift trucks. (E.S.B. 15003/55. Ten/14648.)*

Syria.—20th September. Lattakia Port Company. Complete equipment for generating centre. (E.S.B. 15332/55. Ten/14724.)*

United States.—9th August. Bureau of Reclamation, Boise, Idaho. Distribution transformers and lightning arrestors. (E.S.B. 14598/55. Ten/14653.)*

Windsor.—23rd August. Town Council. Electrical installations in 32 flats on the Manor Farm Close estate. Borough surveyor, Kipling Memorial Building, Alma Road.

1st September. Corporation. Electrical installation in the Corporation depot. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bury (Lancs).—Corporation. 430 steel columns with wiring installation (scheme 2).—Cohen Bros. (Electrical).

Dewsbury.—Housing and Town Planning Committee. Recommended. Electrical installations in 112 dwellings on Ovethorpe Road estate (£2,220).—Hammerton & Waring.

Houghton-le-Spring. — U.D.C. Street lighting, Hindson Crescent South estate: concrete lighting columns.—Stanton Ironworks Co. Lanterns and fittings.—Engineering & Lighting Equipment.

Leeds.—City Council. Recommended. Electrical installations in 406 dwellings on the Intake Lane and Cow Close estates (£9,399).—Hall & Stinson.

Reading.—Corporation Housing Committee. Electric wiring in 96 houses on the Shinfield Road estate (£1,545) and 450 houses on the Oxford Road estate (£7,681).—Southern Electricity Board.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—C. of E. secondary modern school at Moorhead; W. Houston, architect, 30, Burnley Road, Padiham.

Ashford (Middlesex).—Houses (42), on the Convent estate; U.D.C. surveyor, Council Offices, 240, London Road, Staines.

Birkenhead.—Phase 2 of radiotherapeutic extensions at Clatterbridge Hospital for Regional Hospital Board; Lloyd & Cross, Ltd., Argyle Street.

Birmingham.—Dental hospital (12 storeys), on site at rear of Birmingham General Hospital (£500,000); F. Burman, deputy chairman of Board of Governors of United Birmingham Hospitals.

Extensions to the medical school at the University; Wm. Sapcote & Sons, Ltd., 87, Camden Street.

Bootle.—Dry cleaning works at Park Lane, Netherton, for Silvermere Cleaners, Ltd.; Roberts & Sloss, Ltd., 23, Baker Street, Liverpool.

Bradford.—Branch library, Woodside Road, Wyke; city architect.

Brierley Hill.—Dwellings (120), at Tack Farm estate, for U.D.C.; A. & T. Garratt, Ltd., High Street.

Chester.—Further 120 houses at Blacon; Thos. Warrington & Sons, Ltd., Park Drive, Hoole, Cheshire.

Chesterfield.—Further 90 houses for Town Council as continuation of Whittington estate; borough architect.

Consett.—Houses (41), Ebchester; E. Simpkin, U.D.C. surveyor.

Coseley.—Houses (88), Parkfield West site; council surveyor.

Durham.—Flats (32), at New Elvet; city engineer, Town Hall.

Fire brigade headquarters at Durham; county architect, Court Lane.

Ellesmere Port.—Fibre containers factory for Bowater Paper Co., Ltd.; J. Gerrard & Sons, Ltd., Swinton, near Manchester.

Epworth.—Secondary modern school; county architect, Lincoln.

Fleetwood.—Houses (50), West View estate; borough surveyor, Town Hall.

Gloucester.—County training college of domestic science; S. E. Urwin, county architect, Shire Hall.

Hayes and Harlington.—Flats (60), on the Barnhill estate; U.D.C. surveyor, Town Hall, Hayes.

Hexham.—Houses (40); W. A. Hancocks, U.D.C. surveyor.

Ilford.—Reinstatement of Super Cinema, Ley Street; T. P. Bennett & Son, architects, 43, Bloomsbury Square, London, W.C.1.

London.—Store extension; A. W. Gamage, Ltd., Holborn, E.C.1.

Showrooms and offices, Old Bond Street; A. T. Chown & Co., Ltd., 23, Chilworth Street, W.2.

Offices, Pall Mall; F. G. Minter, Ltd., 4, Buckingham Gate, S.W.1.

New school equipment depot in Upper Kennington Lane, Lambeth (£200,000), for L.C.C.; Architects' Department, County Hall, Westminster Bridge, S.E.1.

Nottingham.—Bank premises at Beastmarket Hill, for Barclays Bank, Ltd.; W. Curtis Green, Son & Lloyd, architects, 5, Pickering Place, London, S.W.1.

Padiham.—Factory for Glover & Main, Ltd.; Houston & Forbes, architects, 30, Burnley Road.

Reading.—Home for aged persons in Liebenrood Road (£39,500); G. F. Darlow, town clerk, Town Hall.

Rochdale.—Tyre fabric factory at Bentley Street, for John Bright & Bros., Ltd.; R. & T. Howarth, Ltd., Crossfield Works.

Salisbury.—Flats (53) at The Brambles, London Road, for T.C.; city engineer, Council House, Bourne Hill.

Stratton St. Margaret.—Houses (120); Building & Public Works Construction Co., Ltd., Headlands Grove, Swindon.

Wakefield.—Houses (380), on portion of Kettlethorpe estate; city engineer, Town Hall.

Wallsend.—Hostel for aged persons; county architect, County Hall, Newcastle-on-Tyne.

R.C. church, Carville Road; P. J. Scienlet, 4, Queens Square, Newcastle-on-Tyne.

West Bromwich.—Administrative buildings, Ray Hall Sewage Works; borough engineer.